Environmental Services

Engineering Services

Stormwater Report

Proposed Commercial Building
#39 Alder Street
Medway, MA

Revised: March 4, 2024

Prepared for:

ETS Properties, LLC.
11 Airport Road
Medway, MA 02053

Prepared by:

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ATTACHMENTS

Stormwater Report
Proposed Commercial Building
#39 Alder Street, Medway, MA
Revised: March 4, 2024

Project Description:

The project Applicant*, ETS Properties, LLC* retained *CMG Engineering* to prepare this engineering analysis of pre- and post-development drainage runoff conditions for a proposed **9,600 +/- s.f. Commercial Building.** The proposed site improvements are located on assessor's parcel 63-004 with a total area of 7.42 Acres, identified as #39 Alder Street (Site).

The site is currently undeveloped meadow and woodlands with bordering vegetated wetlands and riverfront area associated with Stall Brook located in the rear portion of the site. The property is located within the West Industrial (WI) zoning district and is within close proximity to municipal water and sewer located within the Alder Street right-of-way. The property also lies within the Town of Medway's Groundwater Protection District, associated with the Zone II Wellhead Protection Area.

The current site topography contains a higher upland area located within the central portion of the site which pitches towards the northeastern and southern areas of the site to the jurisdictional resource areas. An existing stormwater basin is located along the front of the site which is associated with the town owned drainage system located within the Alder Street right-of-way. No other stormwater BMPs are located on site. The rear portion of the site contains bordering vegetated wetlands and riverfront area and will require a Notice of Intent filing with the Medway Conservation Commission.

The applicant is proposing to construct a 9,600 s.f. metal building with associated parking and utilities. The new building will be operated by company that fabricates wood paneling and framing. A storage area will be located behind the building which will be used to store wood pallets and fabricated wooden panels. No materials associated with potential contaminants, nor equipment, will be stored in the outdoor storage area. As a result, the paved storage area is not considered a Land Use with Higher Potential Pollutant Load (LUHPPL). Customer parking will be located in front of the proposed building. As previously stated, the existing parcel is currently undeveloped woodlands, therefore, the project is considered new development.

A copy of the "MA-DEP Checklist for Stormwater Report" is included as **Appendix A**.

Hydrologic Calculation Methodology:

Hydrology

Computer Model: HydroCAD 10.0 © 2015 Applied Microcomputer Systems, drainage modeling software;

Hydrologic Methodology: TR-55 Methodology is used for analysis of peak flow and drywell sizing.

Surface Runoff Conditions

Rainfall Intensity: NOAA Atlas 14 – Rainfall Data
2-Year Storm = 3.39 in.
10-Year Storm = 5.26 in
25-Year Storm = 6.43 in.
100-Year Storm = 8.23 in.

Watershed Areas: Watershed areas are calculated using AutoCAD software based on the subcatchment areas delineated on topographic mapping included as "Pre-Development Drainage" and "Post-Development Drainage". The areas shown, times of concentration and runoff coefficients are all consistent with the TR-55 drainage calculation method.

Flood Plain:

FEMA Flood Mapping: Site is not in the 100-year flood plain based on Flood Insurance Rate Map (FIRM) Town of Medway, Norfolk County Massachusetts (All Jurisdictions) Map Number 25021C0138E, Effective Date July 17, 2012 (see **Appendix B).**

Soils & Topography:

The Site soils are mapped as and appear to be consistent with Scarboro and Birdsall soils (10) with 0 ~ 3% slopes & Merrimac Fine Sandy Loam (254B) with 3 ~ 8% slopes classified as Hydrologic Soil Group "C/D" & "A" respectively.

A copy of the *National Resources Conservation Service* (NRCS) Soils Map, listed area soil types are included as **Appendix C.**

On-Site Soil Testing:

May 13, 2022 Soil Testing – O'Driscoll Land Surveying, Inc. (Daniel O'Driscoll, PLS, LSE)

On November 30, 2022 O'Driscoll Land Surveying, Inc. completed four (4) on-site soil test pits within the proposed project area. The purpose of these test pits was to verify the ESHGW and soil conditions within the proposed stormwater management areas.

Depth to Groundwater:

Estimated seasonal high groundwater (ESHGW) elevations based on soil mottling are as follows:

TP - 1	**TP - 2**	**TP - 3**	**TP – 4**
ESHGW = 52"	**ESHGW=38"**	**ESHGW = 84"**	**ESHGW = 64"**

Soil Conditions:

Test pit TP – 1 was excavated in the vicinity of the proposed metal building to approximately 12 ft. below ground surface (b.g.s.). Soil testing results are consistent with the NRCS mapping for loamy sand with an ESHGW located approximately 4.3 ft. b.g.s.

Test pit TP - 2 was excavated within the limits of the proposed paved storage yard to approximately 10 ft. b.g.s. Soil testing results were also consistent with the NRCS mapping for loamy sand with an ESHGW located approximately 3.1' b.g.s. Groundwater seepage was encountered at 6 ft. b.g.s.

Test pit TP – 3 was excavated in the vicinity of the proposed underground infiltration chambers to approximately 9.3' below ground surface. Soils were consistent with NRCS mapping for loamy sand with ESHGW at 7'b.g.s. Groundwater seepage was encountered at 9.3' b.g.s.

Test pit TP – 4 was excavated in the vicinity of the proposed stormwater basin to approximately 10' b.g.s. Soils were consistent with the rest of the site with loamy sand with ESHGW at 5.3' b.g.s.

Copies of Site Soil Investigation Data are shown on Grading & Drainage Plan, Sheet C-2.0.

Soil Permeability (k):
Based upon on-site classification by a State of Massachusetts Licensed Soil Evaluator Daniel O'Driscoll, PLS, Site subsurface soils within the development area are classified as a "loamy sand". Loamy sands correlate to a "A" type soil classification within the Rawls Rate soil permeability table; therefore, the drainage design permeability has been identified as follows:

Design permeability (k) values of Type "A" Soils:
***k* = 2.41 in / hr** (Rawls Rate: Type "A" Soils) Loamy Sand

Existing Conditions:

The existing site currently consists of one industrial zoned property located at #39 Alder Street with an area of 7.42 Acres. The parcel consists of undeveloped meadow and woodland with bordering vegetated wetlands riverfront area located around the site. The central portion of the site appears to be the highpoint, which pitches due northeast and southwest to the wetland resource areas. There is one stormwater outfall location for the site:

Outfall 1S – Bordering Vegetated Wetlands Approximately 128,222 s.f. of undeveloped meadow and woodland discharges stormwater runoff, via overland flow, to the bordering vegetated wetlands located in the Northeastern portion of the site. No existing stormwater BMP's are present on-site to treat and convey existing stormwater flows. The wetlands appear to be associated with the Stall Brook tributary, which is located in the southeastern portion of the site.

Proposed Conditions:

The project Applicant is proposing to construct a 9,600 s.f. metal building to be used for a company that constructs wood paneling and framing. A paved parking area will be located along the front of the proposed building and a paved storage yard will be located in the rear of the proposed building. The proposed storage yard will be used to store wood pallets and constructed wood panels and framing. As a result, the proposed application is not considered a Land Use with Higher Potential Pollutant Load (LUHPPL). Please note, the rear paved storage area meets the LUHPPL standards due to the use of Hydroworks water quality units (which are proposed to provide the required pretreatment prior to infiltration). CMG is proposing the following Stormwater Management System for the Site in order to meet the MA-DEP Stormwater Management Standards for a new development project.

Outfall 1S – Bordering Vegetated Wetlands Subcatchment 1A consists of the proposed building, paved parking area, and paved storage area. Per the Massachusetts Stormwater Handbook, the paved storage areas will need to achieve 44% TSS removal prior to infiltration. The paved parking and storage area will utilize a combination of deep-sump hooded catch basins and Hydroworks water quality units to capture and pretreat stormwater runoff prior to discharge to a subsurface infiltration system. The subsurface infiltration system consists of Cultec 330 XLHD Rechargers. Two (2) - 6" overflow pipes will then convey stormwater to the rear of the property to riprap aprons. Once discharged, the stormwater flows will be conveyed via overland flow to the bordering vegetated flows. In accordance with the Massachusetts Stormwater Handbook, stormwater runoff from the metal roof (which is located in the Zone II Wellhead Protection Area) will be captured and conveyed to Hydroworks Hydrofilters. Once filtered, roof runoff will also be conveyed to the underground infiltration system. At the request of the Medway Conservation Commission, CMG also implemented a rain garden to capture and treat the front half of the metal roof area. The raingarden utilizes an underdrain which discharges flows to one of the Hydroworks filter in accordance with the Massachusetts Stormwater Handbook.

Subcatchment 1B consists of the proposed landscape areas and undeveloped woodlands located around the perimeter of the proposed paved areas and metal building. Please note, the site contains jurisdictional resource areas with associated buffers, including a 25' "no disturb" buffer, which are located in this subcatchment. The majority of subcatchment 1B remains undisturbed and will contain no structural stormwater BMP's. All stormwater runoff will discharge to the bordering vegetated wetlands via overland flow.

Proposed Stormwater Management System:

Proposed "ETS Equipment Rental" Facility:

- Deep sump hooded catch basins collect runoff for site's impervious and landscaped areas.
- Three (3) Hydrostorm water quality units treat stormwater runoff for the proposed paved parking and storage areas.
- A Hydrostorm Hydrofilter treats stormwater runoff from a portion of the metal roof located within the Zone II Wellhead Protection Area.
- The remaining metal roof area within the Zone II Wellhead Protection Area is treated via a rain garden.
- A proposed underground infiltration system is proposed under the proposed paved storage area to enhance groundwater recharge on-site.
- Site Long-term Operation and Maintenance plan is provided for the Site.

MA-DEP Stormwater Management Standards:

STANDARD 1: (Untreated discharges):
No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

Proposed Full Compliance:

- **Combination of on-site stormwater BMPs including deep sump catch basins with hoods and water quality units provide treatment for on-site stormwater prior to discharge to Outfall 1S.**

STANDARD 2: (Peak rate control and flood prevention):
Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for land subject to coastal storm flowage.

Proposed Full Compliance:

- **No proposed increase to post-development Site peak runoff and Site is not in the 100-year flood plain.**

STANDARD 3: (Recharge to Groundwater):
Loss of annual recharge to ground water shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development conditions based on soil type. This Standard is met when the storm water management system is design to infiltrate the required recharge volume as determined in accordance with the Massachusetts Storm water Handbook.

Proposed Full Compliance:

- **The site will be utilizing infiltration chambers to meet the required recharge.**
- **Site specific BMPs are utilized to pretreat stormwater runoff prior to discharging to infiltration practices.**

STANDARD 4: (TSS Removal):
Stormwater management systems must be designed to remove 80% of the average annual post construction load of Total Suspended Solids (TSS).

Proposed Full Compliance:

- **Outfall 1S –will achieve minimum 97% TSS removal through a combination of deep sump hooded catch basins, water quality units, and an underground infiltration system.**
- **A "Long Term Operation and Maintenance Plan" is being provided as Appendix H.**

STANDARD 5: (Higher Potential Pollutant Loads (LUHPPL)):
For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Storm water Handbook to eliminate or reduce the discharge of storm water runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention, all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, or storm water runoff, the proponent shall use the specific storm water BMP's determined by the Department to be suitable for such use as provided in the Massachusetts Storm water Handbook.

N/A – Site is not considered a LUHPPL

STANDARD 6: (Critical Areas)
Storm water discharges to a Zone II or Interim Wellhead Protection Area of a public water supply and storm water discharges near or any other critical area require the use of the specific storm water best management practices determined by the Department to be suitable for managing discharges to such area as provided in the Massachusetts Storm water Handbook.

Proposed Full Compliance:

- **The site appears to lie within a Zone II. As a result, the on-site stormwater management system was designed to treat the 1" water quality volume and pre-treatment requirements have been met.**

STANDARD 7: (Redevelopment)

"A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable; Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions."

Proposed Full Compliance:

- **Site is considered new development and will meet all applicable Stormwater Management Standards.**

STANDARD 8: (Erosion, Sediment Control):
A plan to control construction related impacts including erosion sedimentation and other pollution prevention sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) must be implemented.

Proposed Full Compliance:

- **The "Erosion and Sedimentation Control Plan" Sheet C-4.0 and "Erosion and Sediment Control Details" Sheet C-4.1 are incorporated into the Plan Set.**
- **Project will disturb > 1 Acre, therefore an EPA–NPDES Stormwater General Permit is required prior to construction and will be accompanied with a comprehensive SWPP Plan.**

STANDARD 9: (Operation and Maintenance):
A long-term operation and maintenance plan must be developed and implemented to ensure that storm water management systems function as designed.

Proposed Full Compliance:

- **Long Term Operation and Maintenance Plan is included in Stormwater Management Report, Appendix H.**

STANDARD 10: (Illicit Discharges):
All illicit discharges to the stormwater management system are prohibited.

Proposed Full Compliance:

- **A signed "illicit discharge compliance statement" will be provided as part of the final "Storm water Management System Long-Term Operation & Maintenance Plan".**

A copy of the "MA-DEP Checklist for Stormwater Report" is included as **Appendix A**.

Table No. 1 provides a summary of off-site Pre- and Post-Development peak runoff flow rates and volumes**.**

Table No. 2 provides a summary of the subcatchment drainage area calculations.

Appendix D & E includes the complete Pre-Development and Post-Development *HydroCAD* drainage calculation reports and **Figures D-1 and D-2 "Pre- "and "Post-Development Drainage Areas" plans**.

Appendix F provides additional stormwater calculations.

Appendix G provides the Manufacturer's Design Report for the two Hydrostorm Water Quality Units.

Appendix H provides a DRAFT "Long Term Stormwater Operation & Maintenance Plan"

The complete Site Plans for the **"Proposed Commercial Building - #39 Alder Street, Medway, MA" prepared by CMG Engineering, revised date 3/4/2024** (or latest version) provide details of the complete storm water management system design**.**

TABLE 1

PRE- VS. POST-DEVELOPMENT STORMWATER RUNOFF SUMMARY

TABLE NO. 1

2/29/2024

STORMWATER RUNOFF PEAK FLOW SUMMARY
ETS EQUIPMENT RENTAL, INC.
#39 ALDER STREET
MEDWAY, MA

Pre-Existing Site Development (Fig D1) Conditions					
		2-Year	**10-Year**	**25-Year**	**100-Year**
1S - WETLANDS	***Peak Flow (cfs)***	***0.00***	***0.05***	***0.21***	***0.99***

Proposed - Site Development (Fig D2) Conditions					
1S - WETLANDS	***Peak Flow (cfs)***	***0.00***	***0.01***	***0.04***	***0.91***

TABLE 2

SUBCATCHMENT DRAINAGE AREA CALCULATIONS

TABLE NO. 2
DRAINAGE AREA CALCULATIONS
ETS EQUIPMENT RENTAL, INC.
#39 ALDER STREET
MEDWAY, MA

PRE-DEVELOPMENT DRAINAGE AREAS (s.f.)

On-Site	Soil Type A						Watershed
Area	Pavement	Roof	Grass/Woods	Woods			Total
1	238		52,617	75,367			128,222
							0
							Total
	238	0	52,617	75,367			**128,222 s.f.**
				Total Site Area=	128,222	s.f.	**2.94** Ac
Total Impervious=		**238 s.f.**			2.94	Ac	
Total Open Space =		**127,984 s.f.**					

POST-DEVELOPMENT DRAINAGE AREAS (s.f.)

On-Site	Soil Type A						Watershed
Area	Pavement	Roof	Grass/Ldscp	Woods			Total
1A	52,070	6,062	4,866				62,998
1B			12,949	47,029			59,978
ROOF		5,246					5,246
							0
							0
							0
							0
							Total
	52,070	11,308	17,815	47,029			***128,222 s.f.***
				Total Site Area=	128,222	s.f.	**2.94** Ac
Total Impervious=		**63,378 s.f.**			2.94	Ac	
Total Open Space =		**64,844 s.f.**					

Note:

[1] All Drainage Areas are calculated using CAD Software based on Pre- & Post Development Drainage Plans prepared by CMG date 3/04/2024

Appendix A

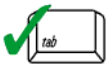
MA-DEP Stormwater Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

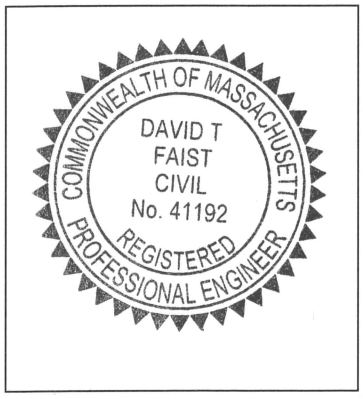
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



3/4/24

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

☒ No disturbance to any Wetland Resource Areas

☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☐ Other (describe): _____

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☒ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☒ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☒ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☒ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

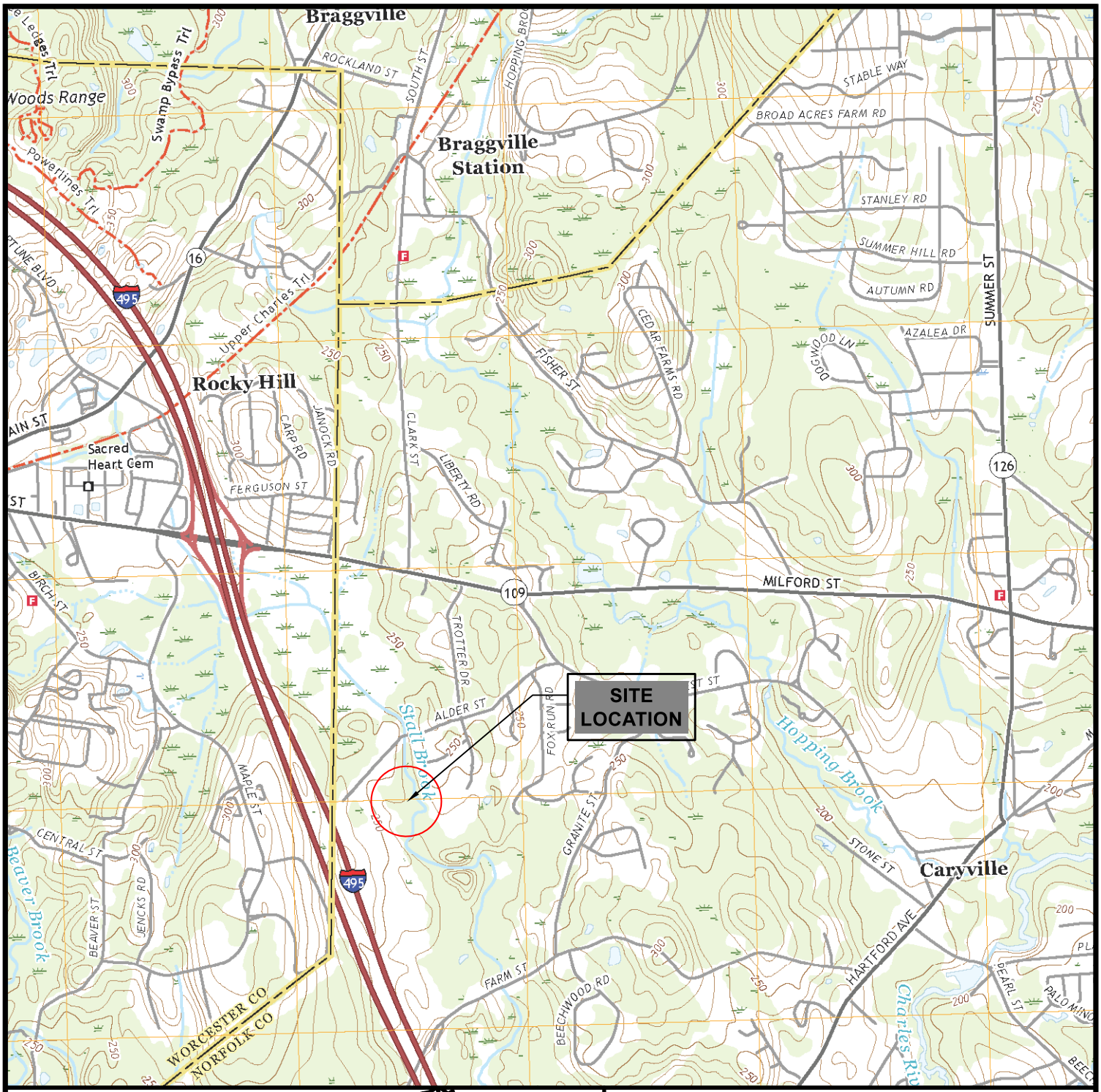
☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

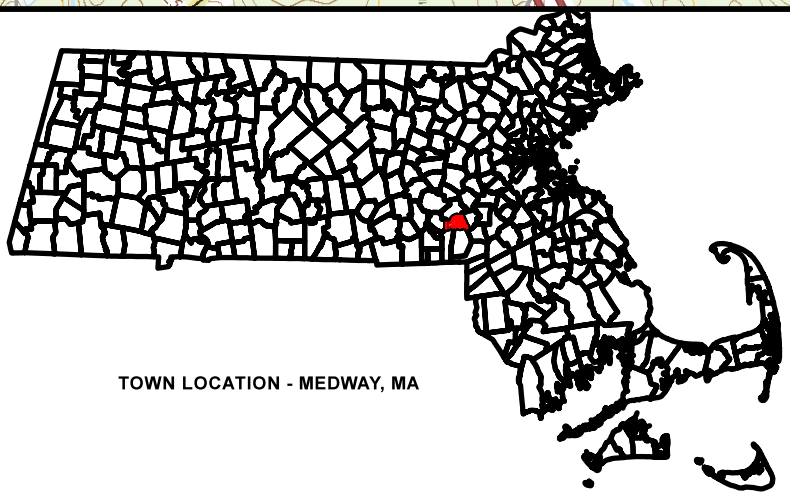
☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Appendix B

USGS FIGURE
FEMA Flood Plain Mapping
NOAA Atlas 14 Precipitation Data





TOWN LOCATION - MEDWAY, MA

FIGURE 1: SITE LOCATION

39 ALDER STREET
MEDWAY, MA 02053
CMG ID 2020-149

SCALE 1:24,000

2000 FT 0 2000 FT

ENVIRONMENTAL SERVICES

CMG EST. 2002

ENGINEERING SERVICES

67 HALL ROAD. STURBRIDGE MA 01566

National Flood Hazard Layer FIRMette

71°28'49"W 42°8'28"N

0 250 500 1,000 1,500 2,000 Feet 1:6,000

71°28'11"W 42°8'1"N

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/20/2022 at 1:40 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

NOAA Atlas 14, Volume 10, Version 3
Location name: Medway, Massachusetts, USA*
Latitude: 42.1389°, Longitude: -71.476°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.333** (0.259-0.426)	**0.401** (0.311-0.513)	**0.511** (0.395-0.656)	**0.602** (0.463-0.777)	**0.728** (0.542-0.984)	**0.824** (0.601-1.14)	**0.923** (0.654-1.32)	**1.03** (0.695-1.52)	**1.19** (0.770-1.81)	**1.31** (0.832-2.05)
10-min	**0.472** (0.367-0.603)	**0.568** (0.440-0.726)	**0.724** (0.560-0.930)	**0.854** (0.656-1.10)	**1.03** (0.768-1.39)	**1.17** (0.851-1.61)	**1.31** (0.926-1.87)	**1.46** (0.984-2.15)	**1.68** (1.09-2.56)	**1.86** (1.18-2.90)
15-min	**0.555** (0.431-0.710)	**0.668** (0.518-0.855)	**0.852** (0.658-1.09)	**1.00** (0.772-1.30)	**1.21** (0.904-1.64)	**1.37** (1.00-1.89)	**1.54** (1.09-2.20)	**1.72** (1.16-2.53)	**1.98** (1.28-3.02)	**2.19** (1.39-3.41)
30-min	**0.758** (0.589-0.969)	**0.913** (0.709-1.17)	**1.17** (0.902-1.50)	**1.38** (1.06-1.78)	**1.67** (1.24-2.25)	**1.89** (1.38-2.61)	**2.12** (1.50-3.03)	**2.37** (1.59-3.48)	**2.73** (1.77-4.15)	**3.01** (1.91-4.69)
60-min	**0.961** (0.746-1.23)	**1.16** (0.899-1.48)	**1.48** (1.15-1.91)	**1.75** (1.35-2.26)	**2.12** (1.58-2.87)	**2.40** (1.75-3.32)	**2.69** (1.91-3.86)	**3.01** (2.03-4.43)	**3.47** (2.25-5.28)	**3.84** (2.43-5.97)
2-hr	**1.23** (0.956-1.56)	**1.49** (1.16-1.89)	**1.92** (1.50-2.46)	**2.28** (1.77-2.93)	**2.78** (2.08-3.74)	**3.15** (2.31-4.33)	**3.54** (2.53-5.07)	**4.00** (2.70-5.84)	**4.66** (3.03-7.06)	**5.22** (3.31-8.06)
3-hr	**1.41** (1.11-1.79)	**1.72** (1.35-2.18)	**2.23** (1.74-2.84)	**2.65** (2.06-3.39)	**3.23** (2.43-4.34)	**3.66** (2.70-5.03)	**4.13** (2.97-5.91)	**4.67** (3.16-6.80)	**5.48** (3.57-8.27)	**6.17** (3.92-9.49)
6-hr	**1.81** (1.43-2.28)	**2.21** (1.74-2.78)	**2.86** (2.24-3.61)	**3.40** (2.65-4.32)	**4.14** (3.14-5.53)	**4.69** (3.48-6.42)	**5.29** (3.83-7.54)	**6.00** (4.07-8.68)	**7.08** (4.62-10.6)	**8.00** (5.11-12.2)
12-hr	**2.30** (1.82-2.87)	**2.80** (2.22-3.50)	**3.62** (2.85-4.54)	**4.29** (3.37-5.42)	**5.22** (3.98-6.93)	**5.91** (4.41-8.03)	**6.66** (4.85-9.44)	**7.56** (5.15-10.9)	**8.94** (5.85-13.3)	**10.1** (6.47-15.3)
24-hr	**2.77** (2.21-3.43)	**3.39** (2.70-4.21)	**4.41** (3.50-5.50)	**5.26** (4.15-6.60)	**6.43** (4.92-8.49)	**7.29** (5.48-9.86)	**8.23** (6.03-11.6)	**9.39** (6.42-13.4)	**11.2** (7.35-16.5)	**12.7** (8.18-19.2)
2-day	**3.15** (2.52-3.88)	**3.92** (3.14-4.83)	**5.18** (4.13-6.41)	**6.22** (4.93-7.75)	**7.66** (5.90-10.1)	**8.71** (6.59-11.7)	**9.87** (7.30-13.9)	**11.3** (7.78-16.1)	**13.7** (9.01-20.1)	**15.7** (10.1-23.5)
3-day	**3.44** (2.76-4.22)	**4.27** (3.43-5.24)	**5.62** (4.50-6.94)	**6.75** (5.37-8.37)	**8.30** (6.41-10.9)	**9.43** (7.16-12.7)	**10.7** (7.93-15.0)	**12.3** (8.44-17.3)	**14.8** (9.77-21.6)	**17.0** (11.0-25.3)
4-day	**3.70** (2.98-4.53)	**4.57** (3.68-5.59)	**5.98** (4.79-7.35)	**7.15** (5.70-8.84)	**8.76** (6.78-11.4)	**9.94** (7.55-13.3)	**11.2** (8.34-15.7)	**12.9** (8.87-18.1)	**15.5** (10.2-22.5)	**17.7** (11.5-26.3)
7-day	**4.44** (3.60-5.41)	**5.36** (4.33-6.53)	**6.85** (5.52-8.38)	**8.09** (6.48-9.96)	**9.80** (7.61-12.7)	**11.1** (8.42-14.7)	**12.4** (9.21-17.2)	**14.1** (9.76-19.7)	**16.7** (11.1-24.2)	**18.9** (12.2-27.9)
10-day	**5.15** (4.18-6.25)	**6.09** (4.94-7.40)	**7.64** (6.17-9.31)	**8.92** (7.16-10.9)	**10.7** (8.30-13.7)	**12.0** (9.13-15.8)	**13.4** (9.91-18.3)	**15.1** (10.4-21.0)	**17.6** (11.7-25.3)	**19.7** (12.8-29.0)
20-day	**7.25** (5.93-8.74)	**8.26** (6.74-9.96)	**9.89** (8.04-12.0)	**11.2** (9.09-13.7)	**13.1** (10.2-16.6)	**14.5** (11.1-18.8)	**16.0** (11.8-21.5)	**17.6** (12.3-24.3)	**19.9** (13.3-28.4)	**21.7** (14.1-31.6)
30-day	**8.99** (7.38-10.8)	**10.0** (8.22-12.1)	**11.7** (9.57-14.1)	**13.1** (10.6-15.9)	**15.1** (11.8-19.0)	**16.6** (12.6-21.2)	**18.0** (13.2-23.9)	**19.6** (13.7-26.9)	**21.6** (14.5-30.8)	**23.2** (15.1-33.7)
45-day	**11.1** (9.17-13.3)	**12.2** (10.0-14.6)	**14.0** (11.5-16.8)	**15.4** (12.6-18.7)	**17.5** (13.7-21.8)	**19.0** (14.5-24.2)	**20.6** (15.1-26.9)	**22.0** (15.5-30.0)	**23.8** (16.0-33.7)	**25.1** (16.4-36.3)
60-day	**12.9** (10.7-15.4)	**14.1** (11.6-16.8)	**15.9** (13.0-19.0)	**17.4** (14.2-20.9)	**19.5** (15.2-24.2)	**21.1** (16.1-26.7)	**22.7** (16.6-29.4)	**24.0** (16.9-32.6)	**25.6** (17.3-36.1)	**26.7** (17.4-38.5)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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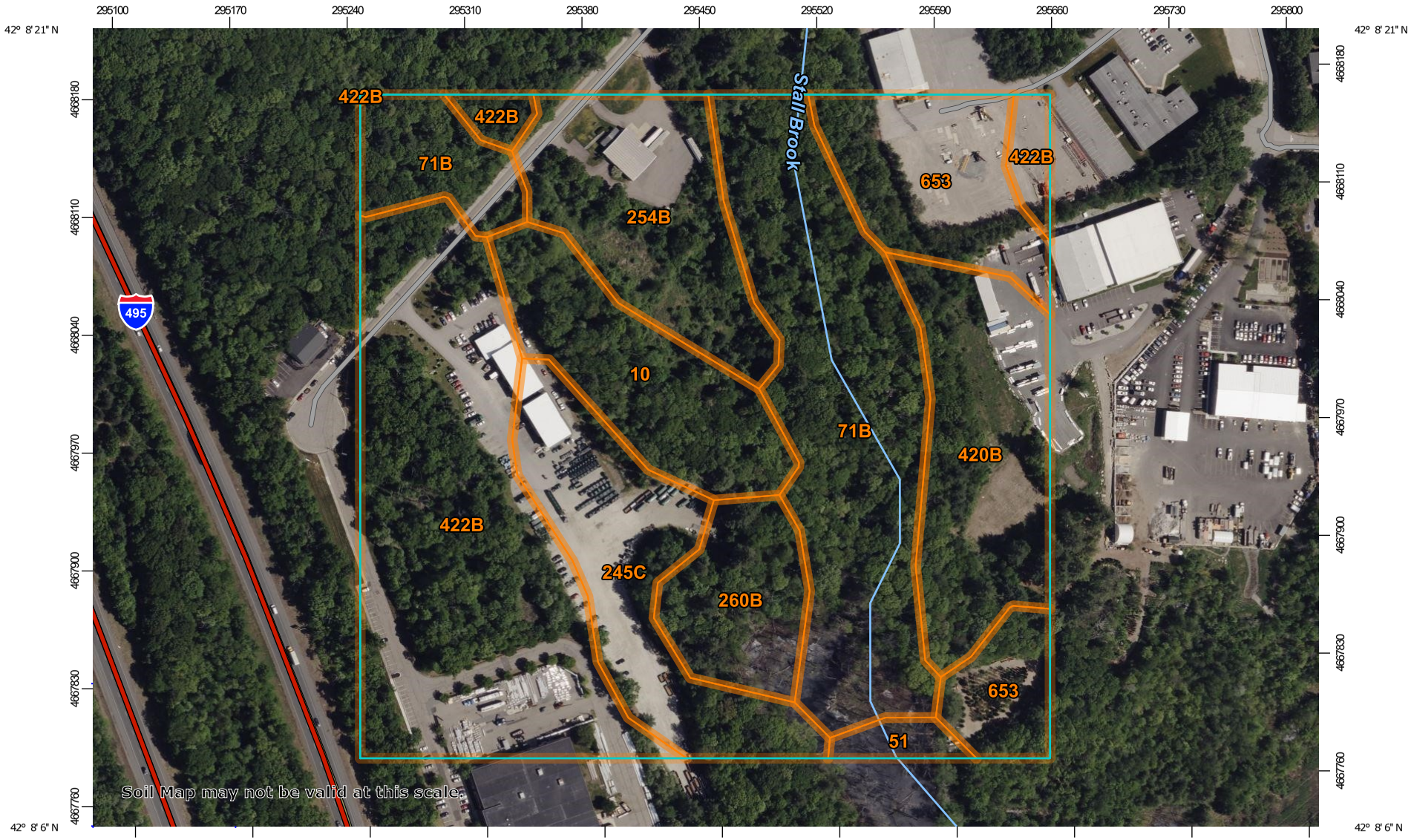
PF graphical

Appendix C

NCRS Soil Mapping

Soil Map—Norfolk and Suffolk Counties, Massachusetts



Map Scale: 1:3,340 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 45 90 180 270

Feet
0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 18, Sep 9, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10	Scarboro and Birdsall soils, 0 to 3 percent slopes	3.3	8.1%
51	Swansea muck, 0 to 1 percent slopes	0.4	1.0%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	8.7	21.7%
245C	Hinckley loamy sand, 8 to 15 percent slopes	3.9	9.8%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	3.9	9.7%
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	2.0	5.1%
420B	Canton fine sandy loam, 3 to 8 percent slopes	4.2	10.3%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	9.9	24.5%
653	Udorthents, sandy	4.0	9.8%
Totals for Area of Interest		**40.3**	**100.0%**

Norfolk and Suffolk Counties, Massachusetts

10—Scarboro and Birdsall soils, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vkxw
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Scarboro and similar soils: 65 percent
Birdsall and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scarboro

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 9 inches: mucky fine sandy loam
H2 - 9 to 60 inches: stratified loamy fine sand to gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Description of Birdsall

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Soft coarse-silty glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: very fine sandy loam
H2 - 8 to 16 inches: very fine sandy loam
H3 - 16 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 12.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 5 percent
Landform: Bogs
Hydric soil rating: Yes

Raynham

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Walpole

Percent of map unit: 2 percent
Landform: Terraces

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 18, Sep 9, 2022

Norfolk and Suffolk Counties, Massachusetts

254B—Merrimac fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyqs
Elevation: 0 to 1,290 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Merrimac and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0

Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Windsor

Percent of map unit: 3 percent
Landform: Outwash plains, outwash terraces, dunes, deltas
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Agawam

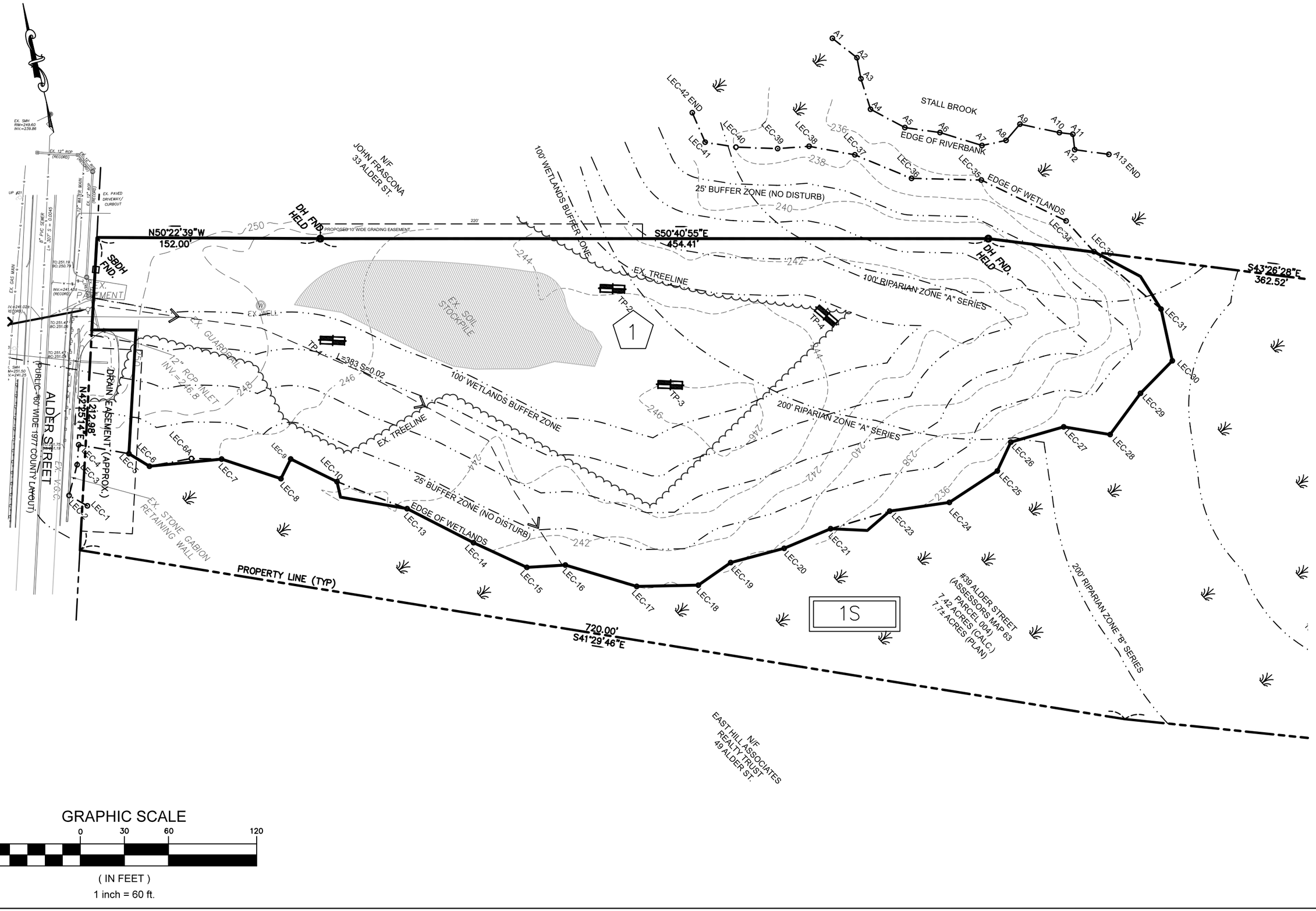
Percent of map unit: 2 percent
Landform: Outwash plains, outwash terraces, moraines, stream terraces, eskers, kames
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Data Source Information

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 18, Sep 9, 2022

Appendix D

Pre-Development Drainage Calculations



GRAPHIC SCALE

60 0 30 60 120

(IN FEET)

1 inch = 60 ft.

NO.	DATE	DESCRIPTION	BY	CKD
1.	3/4/2024	CLIENT CHANGE OF USE / BUILDING	RL	DTF

REVISIONS

PROFESSIONAL SEAL

PROJECT:

PROPOSED COMMERCIAL BUILDING
#39 ALDER STREET
MEDWAY, MA 02053

PREPARED FOR:

ETS EQUIPMENT RENTAL, INC.
11 AIRPORT ROAD
HOPEDALE, MA 01747

ENGINEERING SERVICES
ENVIRONMENTAL SERVICES

67 Hall Road
Sturbridge, MA 01566
Phone: 774-241-0901
fax: 774-241-0906

CMG EST. 2002

ISSUE DATE: 2/16/2024

DRAWN BY: RL | CHECKED BY: DTF

SCALE: 1" = 60'

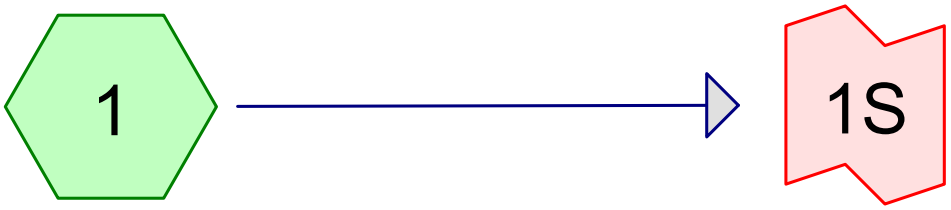
PROJECT NO. 2020-149

SHEET NAME:

PRE-DEVELOPMENT
DRAINAGE MAP

SHEET NO.:

D - 1.0



EX WOODS

OFF-SITE RUNOFF - WETLANDS

Subcat Reach Pond Link

Routing Diagram for 2020-149-PRE_DEV_REV1
Prepared by CMG, Printed 10/17/2023

Summary for Subcatchment 1: EX WOODS

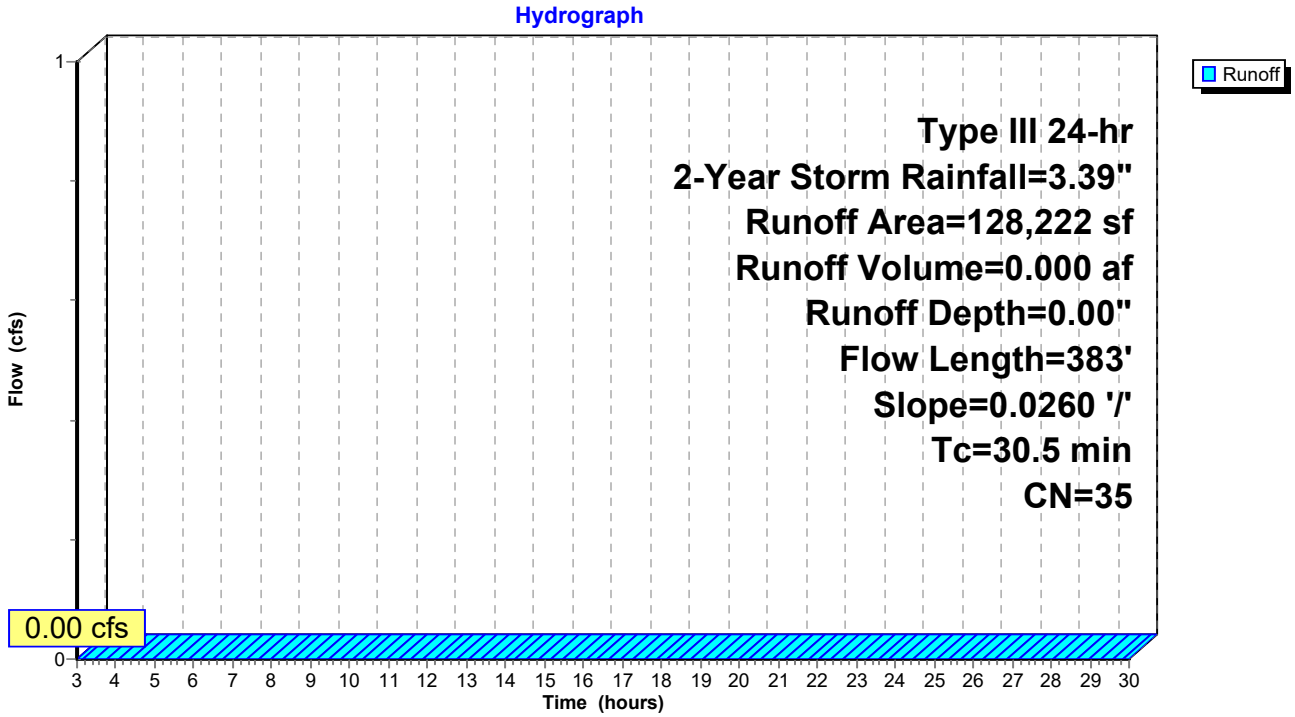
Runoff = 0.00 cfs @ 3.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 3.00-30.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Storm Rainfall=3.39"

Area (sf)	CN	Description
75,367	30	Woods, Good, HSG A
238	98	Paved parking, HSG A
52,617	43	Woods/grass comb., Fair, HSG A
128,222	35	Weighted Average
127,984		99.81% Pervious Area
238		0.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	383	0.0260	0.21		**Lag/CN Method, CN/LAG METHOD**

Subcatchment 1: EX WOODS

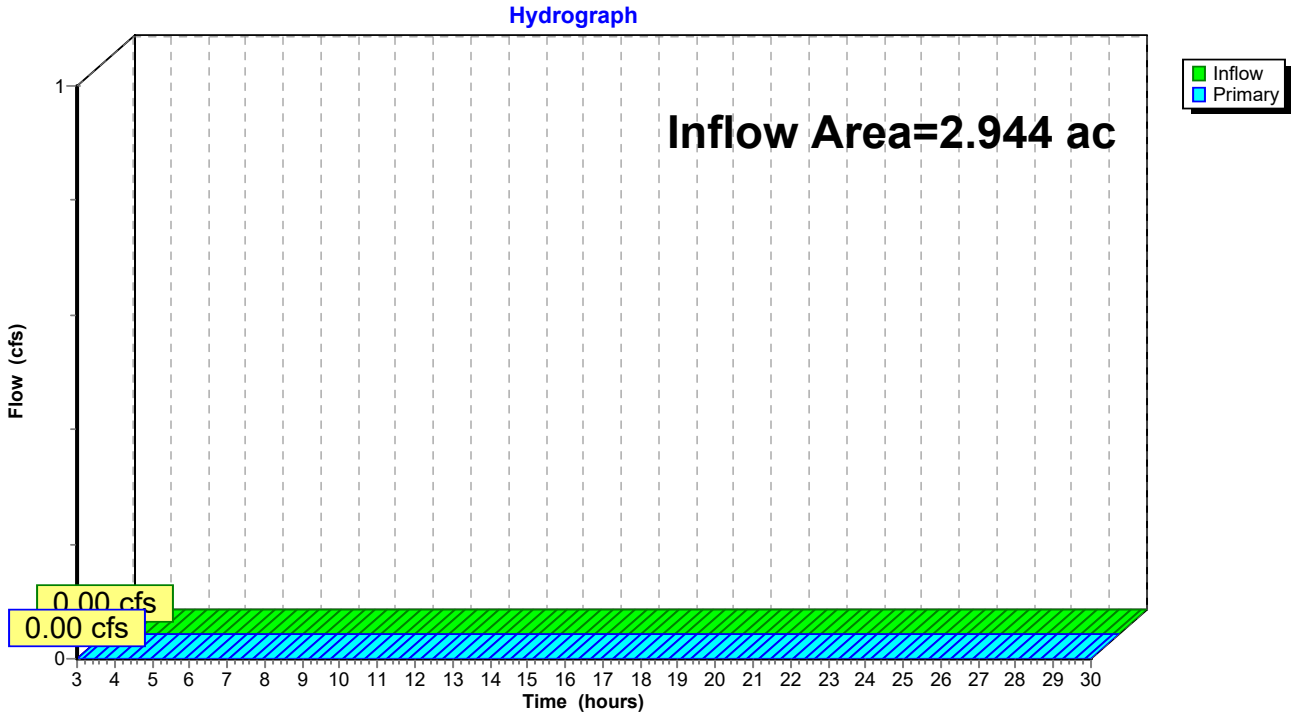


Summary for Link 1S: OFF-SITE RUNOFF - WETLANDS

Inflow Area = 2.944 ac, 0.19% Impervious, Inflow Depth = 0.00" for 2-Year Storm event
Inflow = 0.00 cfs @ 3.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 3.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 3.00-30.00 hrs, dt= 0.03 hrs

Link 1S: OFF-SITE RUNOFF - WETLANDS



Summary for Subcatchment 1: EX WOODS

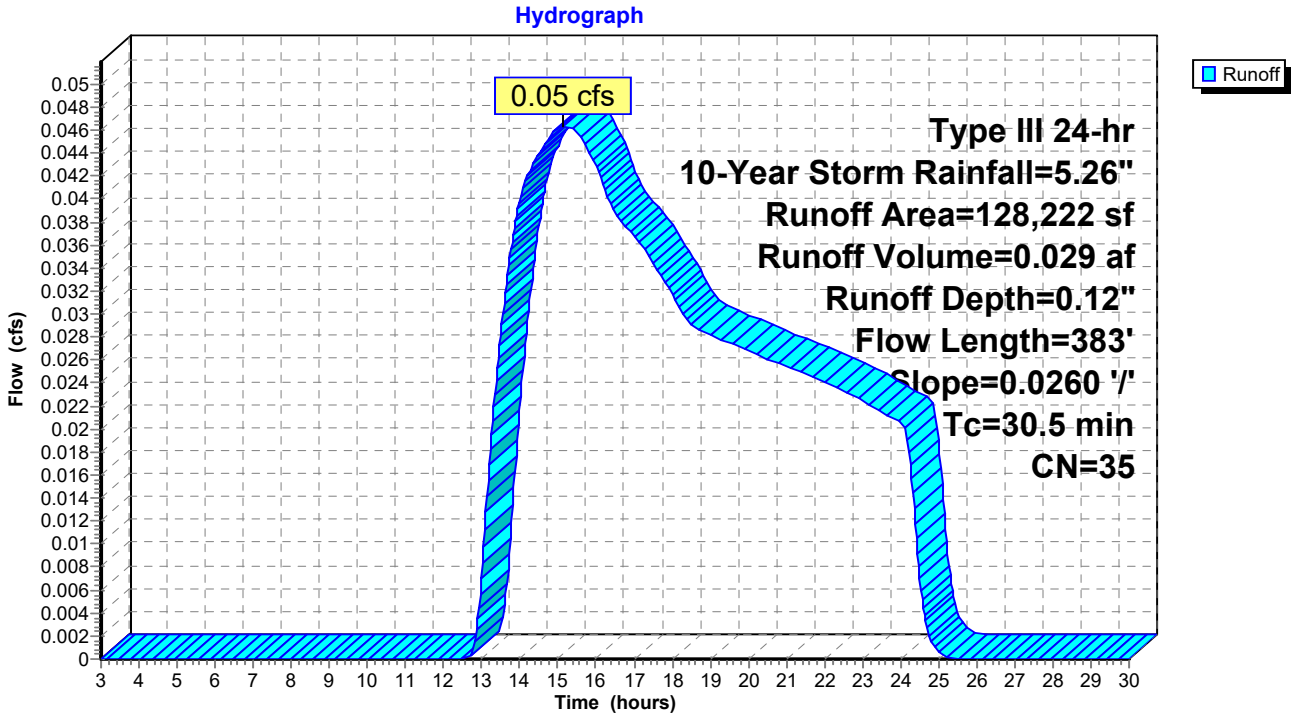
Runoff = 0.05 cfs @ 15.15 hrs, Volume= 0.029 af, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 3.00-30.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Storm Rainfall=5.26"

Area (sf)	CN	Description
75,367	30	Woods, Good, HSG A
238	98	Paved parking, HSG A
52,617	43	Woods/grass comb., Fair, HSG A
128,222	35	Weighted Average
127,984		99.81% Pervious Area
238		0.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	383	0.0260	0.21		**Lag/CN Method, CN/LAG METHOD**

Subcatchment 1: EX WOODS

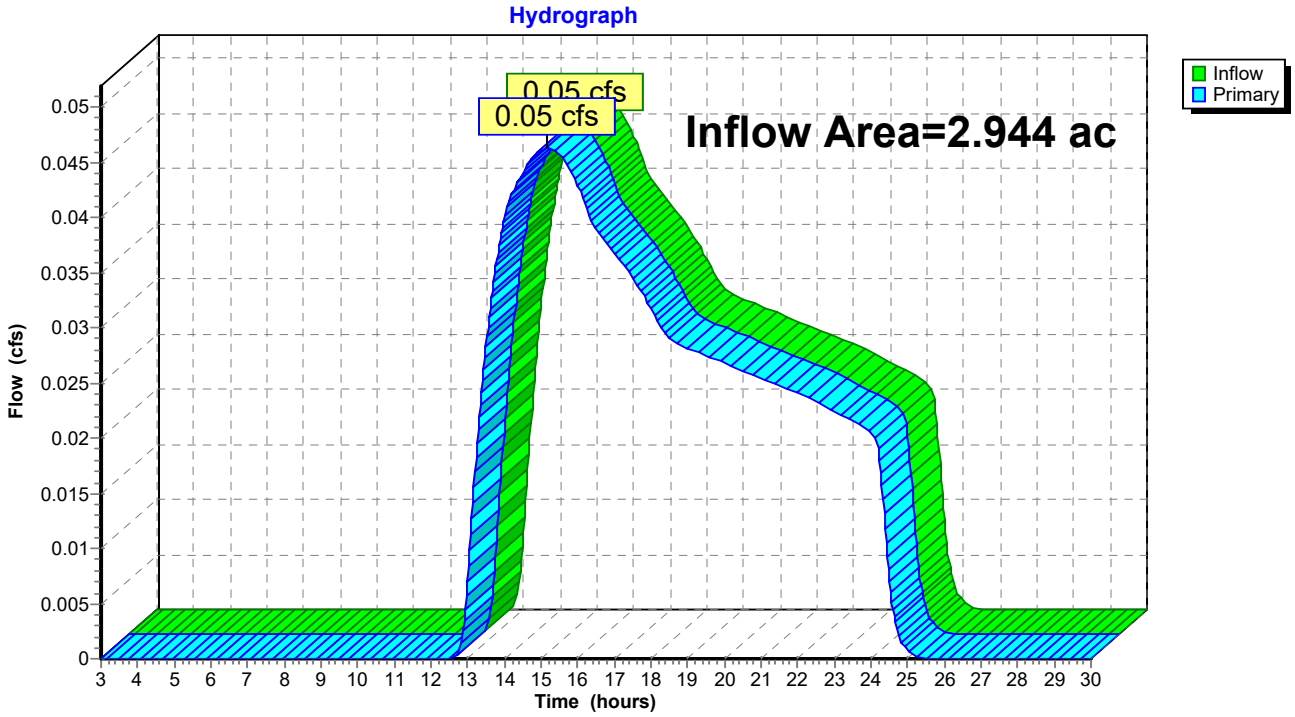


Summary for Link 1S: OFF-SITE RUNOFF - WETLANDS

Inflow Area = 2.944 ac, 0.19% Impervious, Inflow Depth = 0.12" for 10-Year Storm event
Inflow = 0.05 cfs @ 15.15 hrs, Volume= 0.029 af
Primary = 0.05 cfs @ 15.15 hrs, Volume= 0.029 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 3.00-30.00 hrs, dt= 0.03 hrs

Link 1S: OFF-SITE RUNOFF - WETLANDS



Summary for Subcatchment 1: EX WOODS

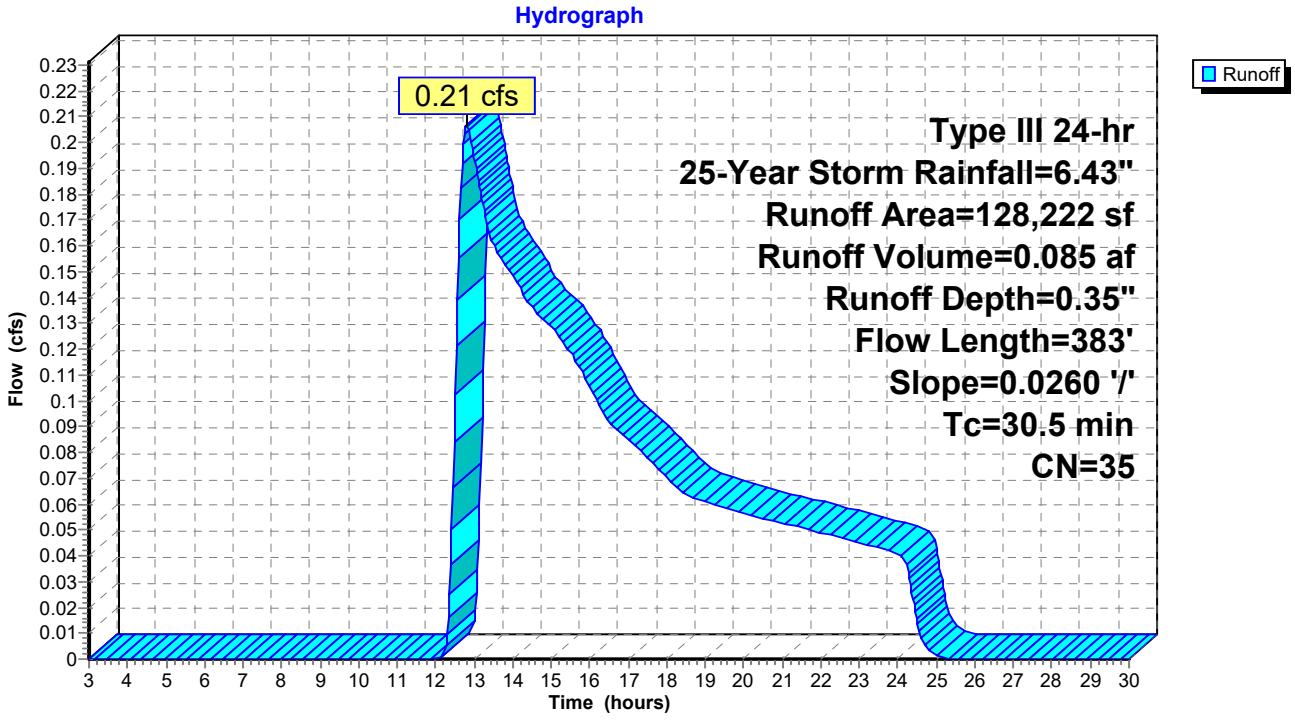
Runoff = 0.21 cfs @ 12.81 hrs, Volume= 0.085 af, Depth= 0.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 3.00-30.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Storm Rainfall=6.43"

Area (sf)	CN	Description
75,367	30	Woods, Good, HSG A
238	98	Paved parking, HSG A
52,617	43	Woods/grass comb., Fair, HSG A
128,222	35	Weighted Average
127,984		99.81% Pervious Area
238		0.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	383	0.0260	0.21		**Lag/CN Method, CN/LAG METHOD**

Subcatchment 1: EX WOODS

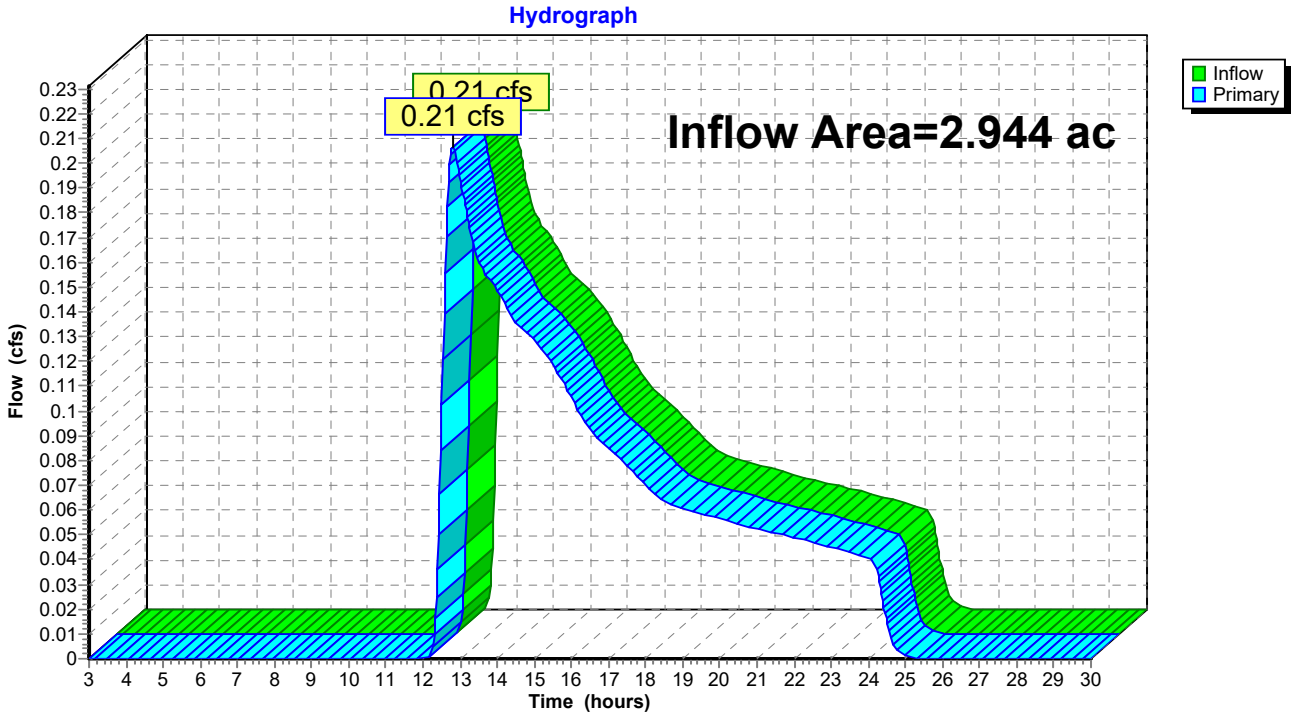


Summary for Link 1S: OFF-SITE RUNOFF - WETLANDS

Inflow Area = 2.944 ac, 0.19% Impervious, Inflow Depth = 0.35" for 25-Year Storm event
Inflow = 0.21 cfs @ 12.81 hrs, Volume= 0.085 af
Primary = 0.21 cfs @ 12.81 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 3.00-30.00 hrs, dt= 0.03 hrs

Link 1S: OFF-SITE RUNOFF - WETLANDS



Summary for Subcatchment 1: EX WOODS

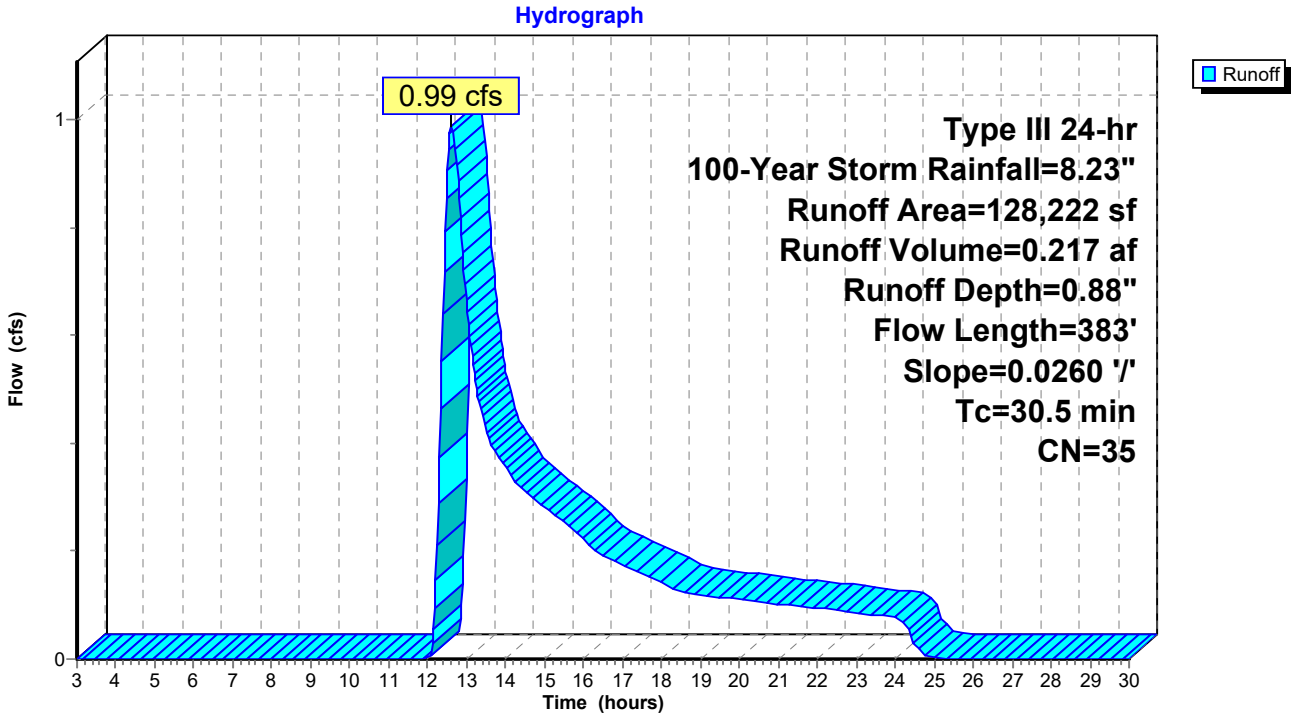
Runoff = 0.99 cfs @ 12.62 hrs, Volume= 0.217 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 3.00-30.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Storm Rainfall=8.23"

Area (sf)	CN	Description
75,367	30	Woods, Good, HSG A
238	98	Paved parking, HSG A
52,617	43	Woods/grass comb., Fair, HSG A
128,222	35	Weighted Average
127,984		99.81% Pervious Area
238		0.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	383	0.0260	0.21		**Lag/CN Method, CN/LAG METHOD**

Subcatchment 1: EX WOODS

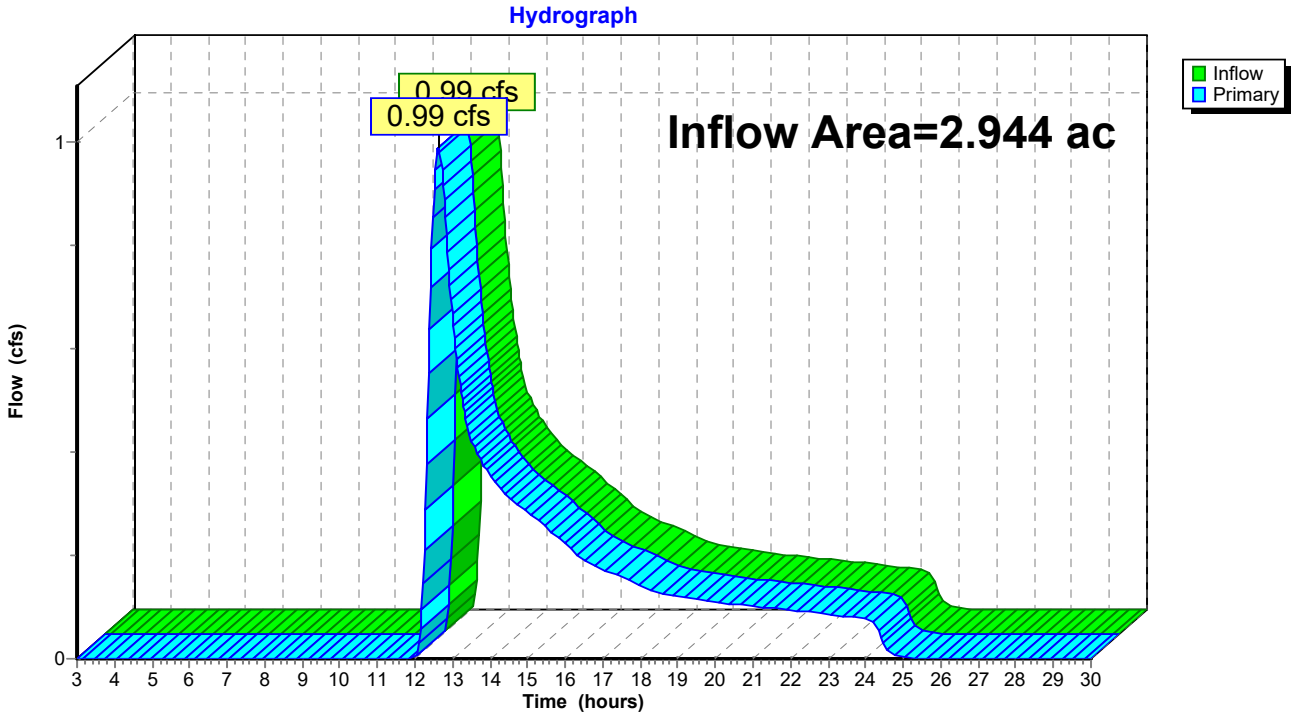


Summary for Link 1S: OFF-SITE RUNOFF - WETLANDS

Inflow Area = 2.944 ac, 0.19% Impervious, Inflow Depth = 0.88" for 100-Year Storm event
Inflow = 0.99 cfs @ 12.62 hrs, Volume= 0.217 af
Primary = 0.99 cfs @ 12.62 hrs, Volume= 0.217 af, Atten= 0%, Lag= 0.0 min

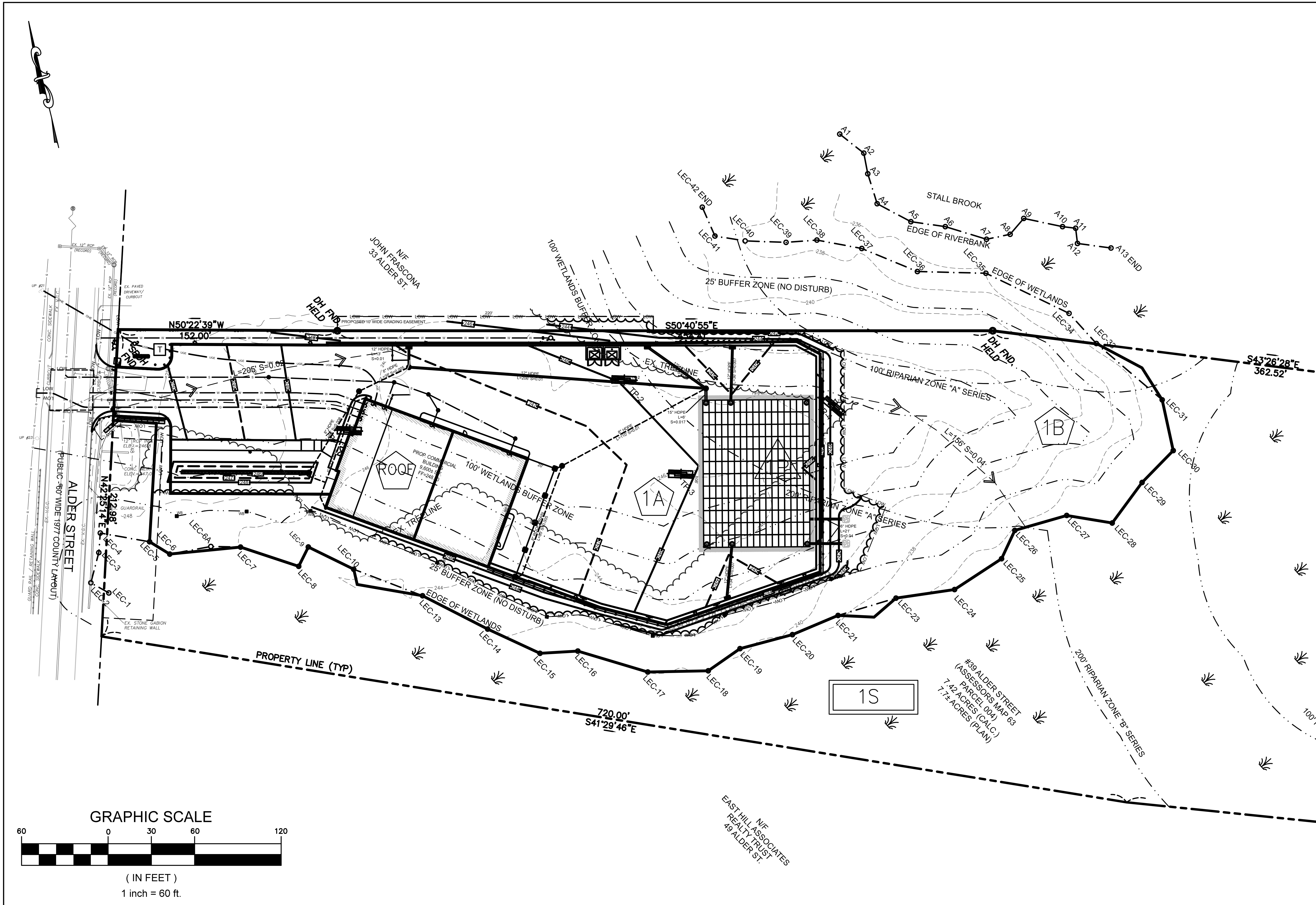
Primary outflow = Inflow, Time Span= 3.00-30.00 hrs, dt= 0.03 hrs

Link 1S: OFF-SITE RUNOFF - WETLANDS



Appendix E

Post-Development Drainage Calculations



NO.	DATE	DESCRIPTION	BY	CK'D
1.	3/4/2024	CLIENT CHANGE OF USE / BUILDING	RL	DTF

REVISIONS

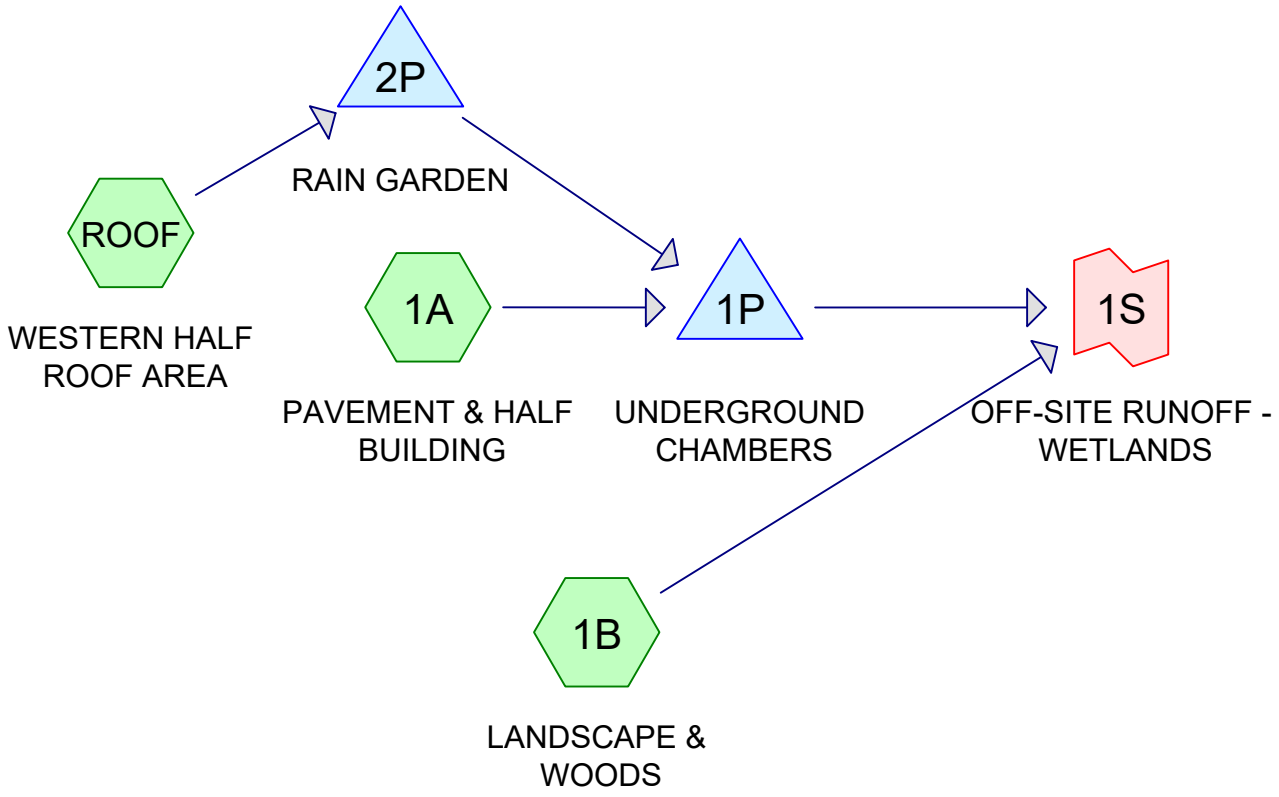
PROFESSIONAL SEAL

PROJECT:
PROPOSED COMMERCIAL BUILDING
#39 ALDER STREET
MEDWAY, MA 02053

PREPARED FOR:
ETS EQUIPMENT RENTAL, INC.
11 AIRPORT ROAD
HOPEDALE, MA 01747

ENGINEERING SERVICES
ENVIRONMENTAL SERVICES
67 Hall Road
Sturbridge, MA 01566
Phone: 774-241-0901
fax: 774-241-0906
CMG EST. 2002

ISSUE DATE: 2/16/2024
DRAWN BY: RL CHECKED BY: DTF
SCALE: 1" = 60'
PROJECT NO: 2020-149
SHEET NAME:
POST-DEVELOPMENT DRAINAGE MAP
SHEET NO:
D - 2.0



Subcat Reach Pond Link

Routing Diagram for 2020-149-POST_DEV-CHAMBERS_REV2
Prepared by CMG, Printed 3/1/2024

Summary for Subcatchment 1A: PAVEMENT & HALF BUILDING

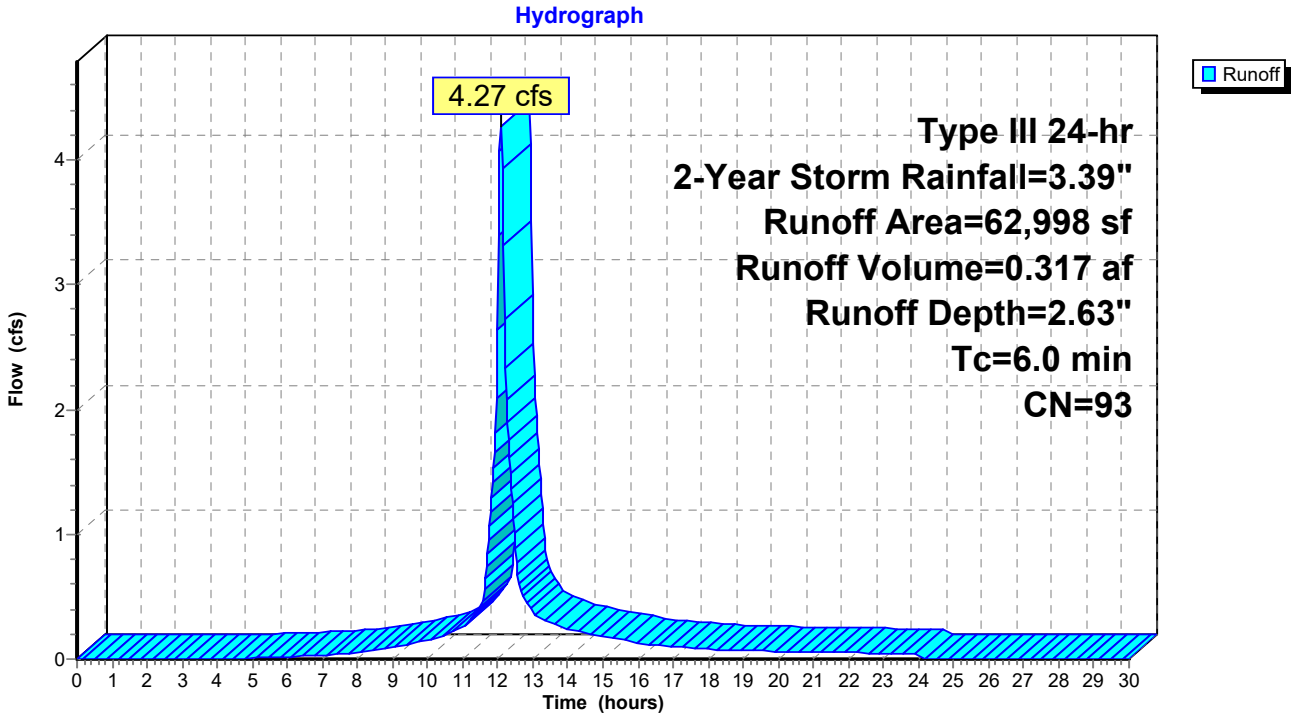
Runoff = 4.27 cfs @ 12.09 hrs, Volume= 0.317 af, Depth= 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Storm Rainfall=3.39"

Area (sf)	CN	Description
6,062	98	Roofs, HSG A
52,070	98	Paved parking, HSG A
4,866	39	>75% Grass cover, Good, HSG A
62,998	93	Weighted Average
4,866		7.72% Pervious Area
58,132		92.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, DIRECT**

Subcatchment 1A: PAVEMENT & HALF BUILDING



Summary for Subcatchment 1B: LANDSCAPE & WOODS

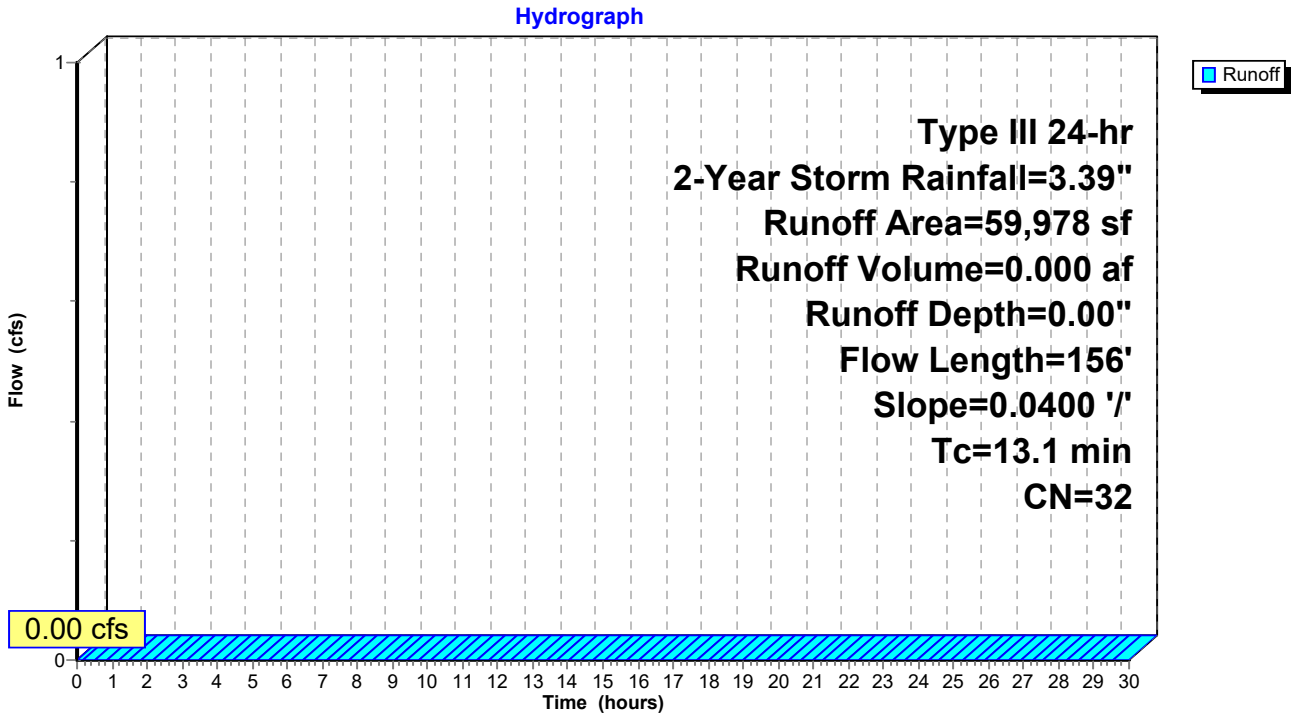
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Storm Rainfall=3.39"

Area (sf)	CN	Description
12,949	39	>75% Grass cover, Good, HSG A
47,029	30	Woods, Good, HSG A
59,978	32	Weighted Average
59,978		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	156	0.0400	0.20		**Lag/CN Method,**

Subcatchment 1B: LANDSCAPE & WOODS



Summary for Subcatchment ROOF: WESTERN HALF ROOF AREA

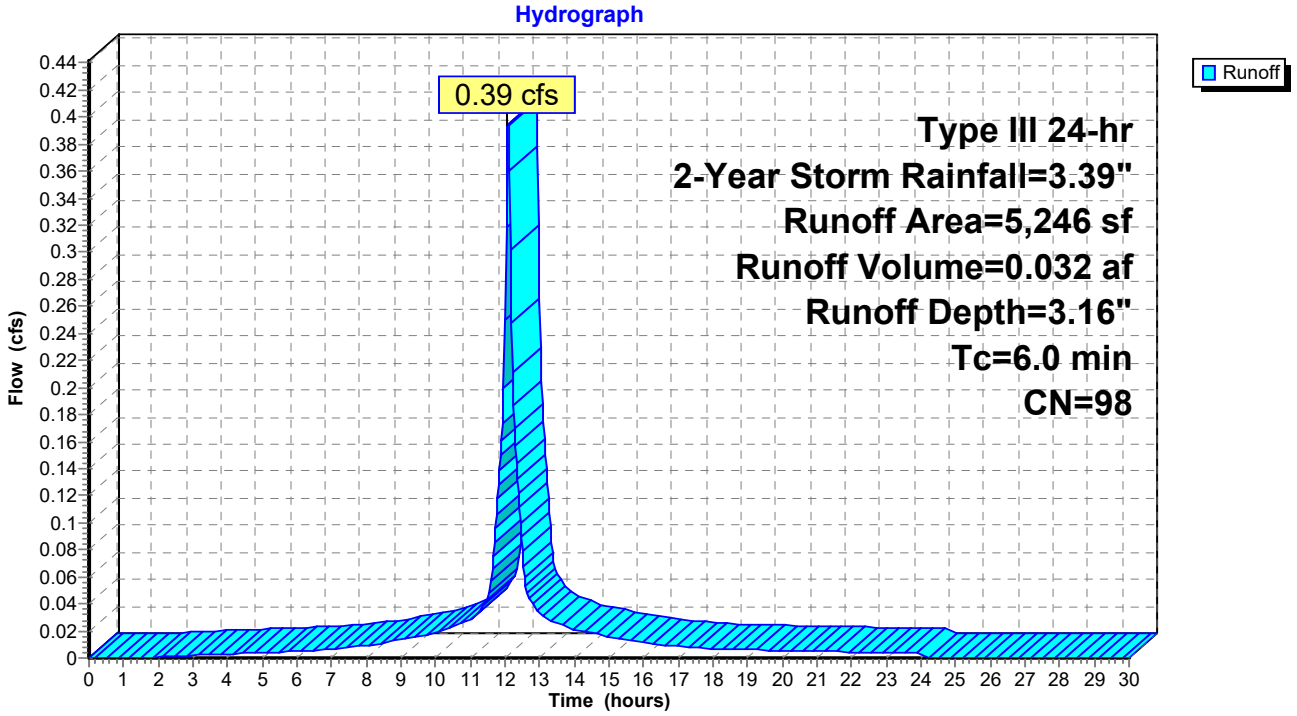
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Storm Rainfall=3.39"

Area (sf)	CN	Description
5,246	98	Roofs, HSG A
5,246		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Direct**

Subcatchment ROOF: WESTERN HALF ROOF AREA



Summary for Pond 1P: UNDERGROUND CHAMBERS

Inflow Area = 1.567 ac, 92.87% Impervious, Inflow Depth = 2.43" for 2-Year Storm event
Inflow = 4.27 cfs @ 12.09 hrs, Volume= 0.317 af
Outflow = 0.69 cfs @ 12.56 hrs, Volume= 0.317 af, Atten= 84%, Lag= 28.7 min
Discarded = 0.69 cfs @ 12.56 hrs, Volume= 0.317 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Peak Elev= 241.37' @ 12.56 hrs Surf.Area= 8,603 sf Storage= 4,287 cf

Plug-Flow detention time= 43.9 min calculated for 0.316 af (100% of inflow)
Center-of-Mass det. time= 43.9 min (834.6 - 790.7)

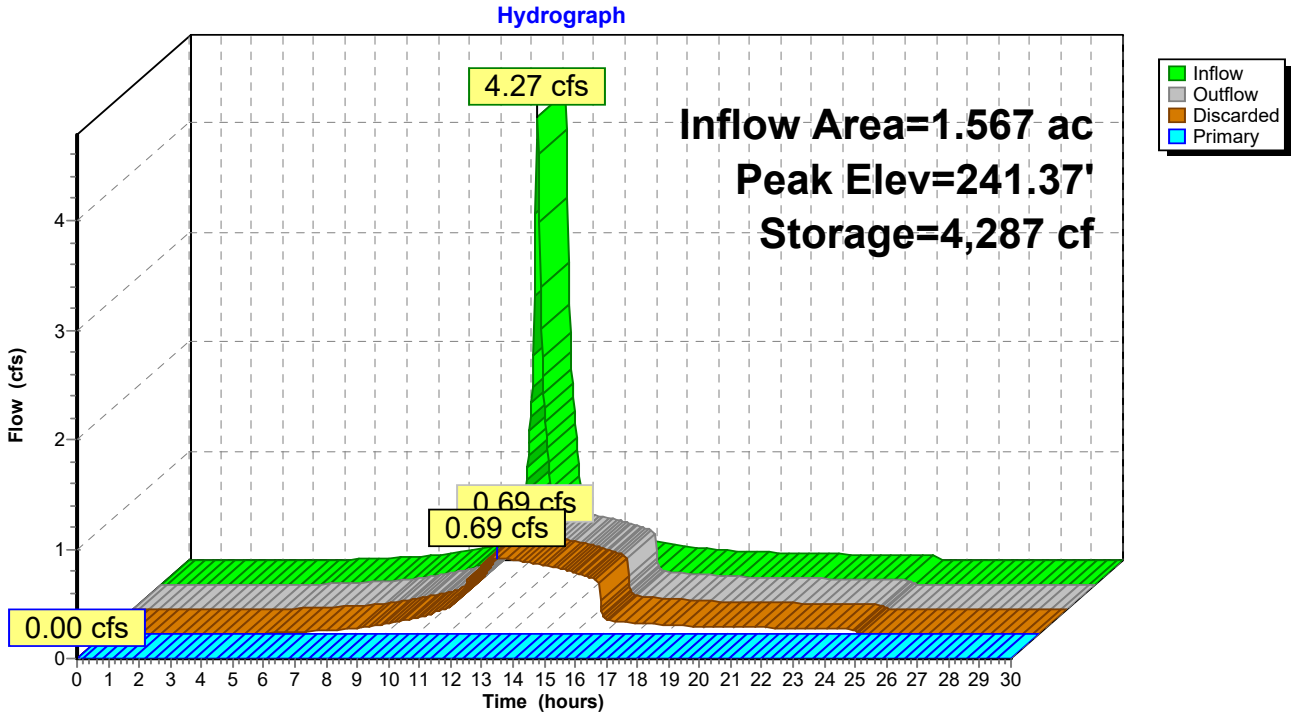
Volume	Invert	Avail.Storage	Storage Description
#1	240.50'	7,713 cf	**79.66'W x 108.00'L x 3.50'H Stone Surround** 30,111 cf Overall - 10,830 cf Embedded = 19,281 cf x 40.0% Voids
#2	241.00'	10,830 cf	**Cultec R-330XLHD** x 204 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 17 rows
		18,543 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	240.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 238.50'
#2	Primary	242.83'	**6.0" Round Culvert X 2.00** L= 21.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 242.83' / 242.00' S= 0.0395 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.69 cfs @ 12.56 hrs HW=241.37' (Free Discharge)
↑**1=Exfiltration** (Controls 0.69 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=240.50' (Free Discharge)
↑**2=Culvert** (Controls 0.00 cfs)

Pond 1P: UNDERGROUND CHAMBERS



Summary for Pond 2P: RAIN GARDEN

Inflow Area = 0.120 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year Storm event
Inflow = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af
Outflow = 0.06 cfs @ 12.55 hrs, Volume= 0.032 af, Atten= 84%, Lag= 28.0 min
Discarded = 0.06 cfs @ 12.55 hrs, Volume= 0.032 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Peak Elev= 246.96' @ 12.55 hrs Surf.Area= 1,030 sf Storage= 408 cf

Plug-Flow detention time= 43.1 min calculated for 0.032 af (100% of inflow)
Center-of-Mass det. time= 43.0 min (798.2 - 755.2)

Volume	Invert	Avail.Storage	Storage Description
#1	246.50'	1,829 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

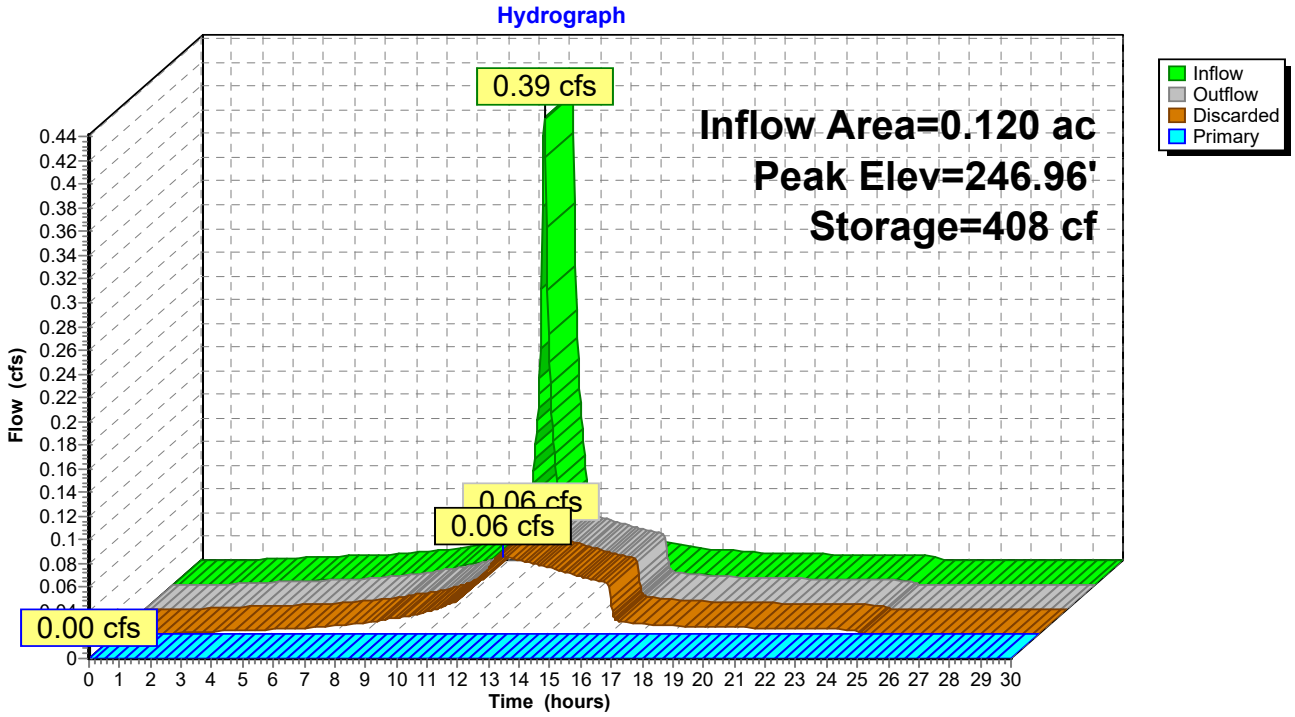
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
246.50	744	202.0	0	0	744
247.00	1,056	214.0	448	448	1,155
248.00	1,734	238.0	1,381	1,829	2,047

Device	Routing	Invert	Outlet Devices
#1	Discarded	246.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 243.45'
#2	Primary	247.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.06 cfs @ 12.55 hrs HW=246.96' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=246.50' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 2P: RAIN GARDEN

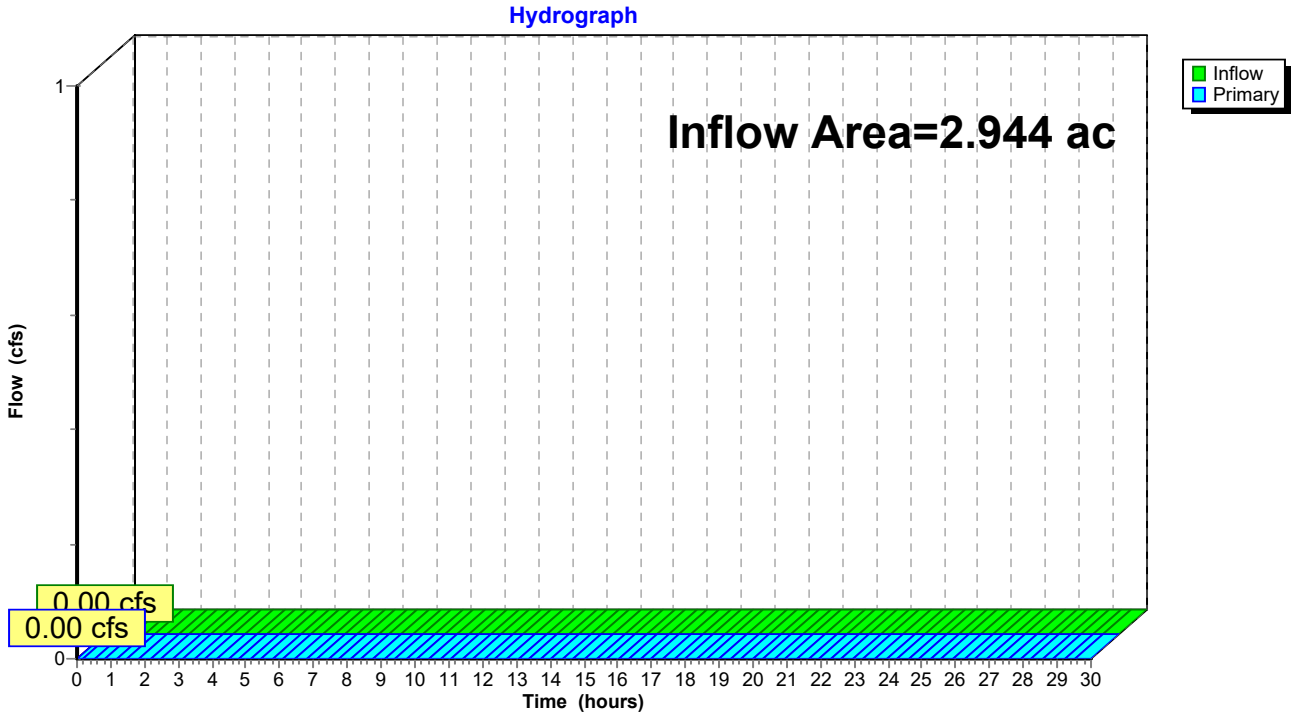


Summary for Link 1S: OFF-SITE RUNOFF - WETLANDS

Inflow Area = 2.944 ac, 49.43% Impervious, Inflow Depth = 0.00" for 2-Year Storm event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs

Link 1S: OFF-SITE RUNOFF - WETLANDS



Summary for Subcatchment 1A: PAVEMENT & HALF BUILDING

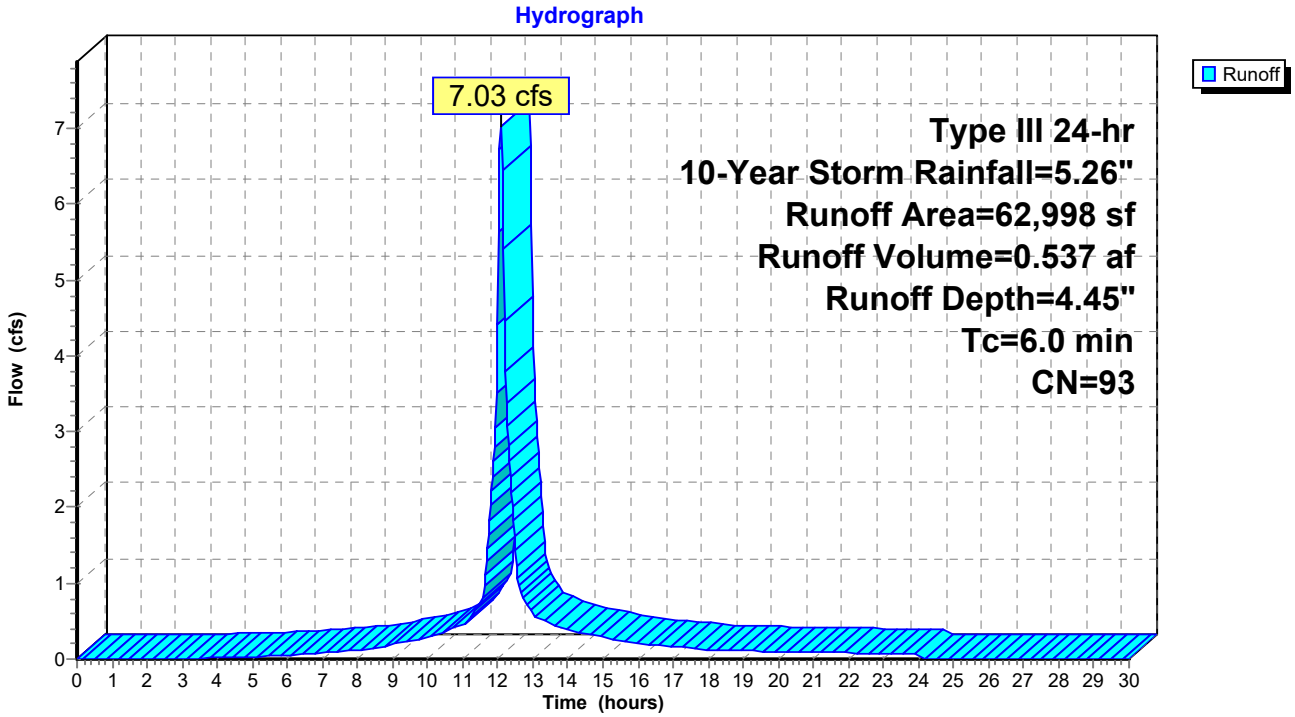
Runoff = 7.03 cfs @ 12.09 hrs, Volume= 0.537 af, Depth= 4.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Storm Rainfall=5.26"

Area (sf)	CN	Description
6,062	98	Roofs, HSG A
52,070	98	Paved parking, HSG A
4,866	39	>75% Grass cover, Good, HSG A
62,998	93	Weighted Average
4,866		7.72% Pervious Area
58,132		92.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, DIRECT**

Subcatchment 1A: PAVEMENT & HALF BUILDING



Summary for Subcatchment 1B: LANDSCAPE & WOODS

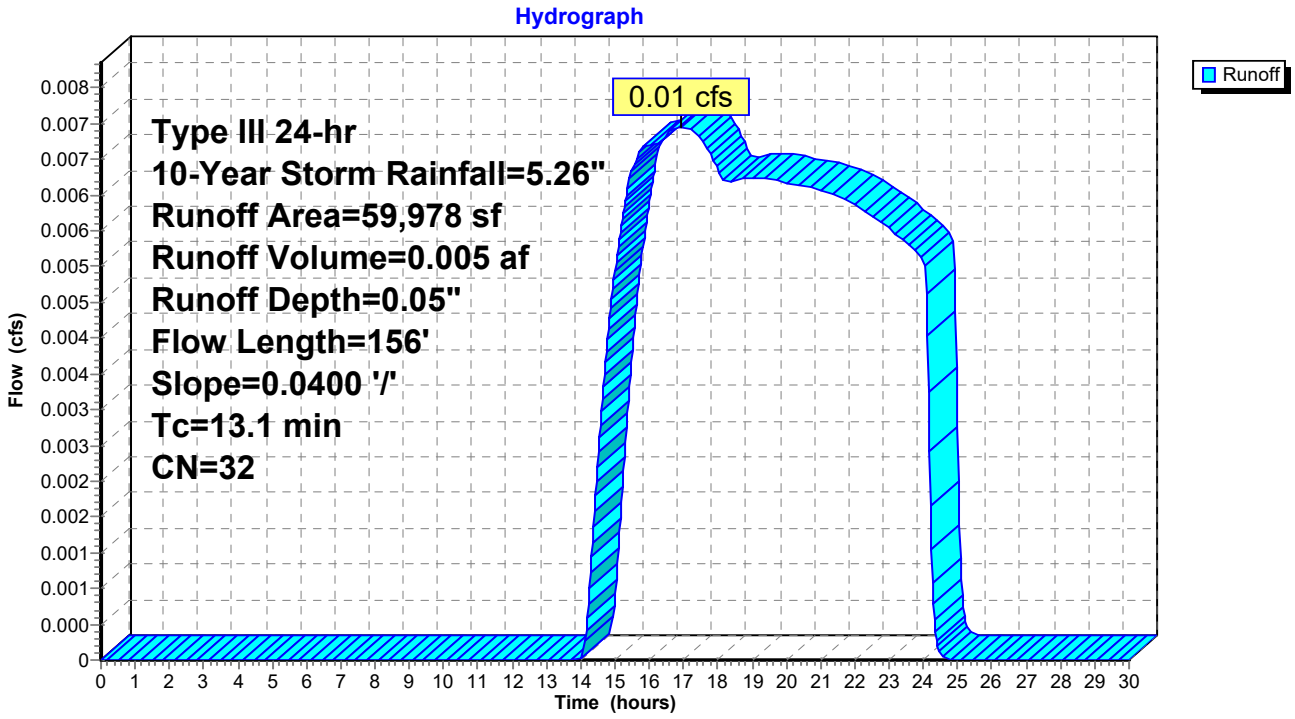
Runoff = 0.01 cfs @ 16.94 hrs, Volume= 0.005 af, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Storm Rainfall=5.26"

Area (sf)	CN	Description
12,949	39	>75% Grass cover, Good, HSG A
47,029	30	Woods, Good, HSG A
59,978	32	Weighted Average
59,978		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	156	0.0400	0.20		**Lag/CN Method,**

Subcatchment 1B: LANDSCAPE & WOODS



Summary for Subcatchment ROOF: WESTERN HALF ROOF AREA

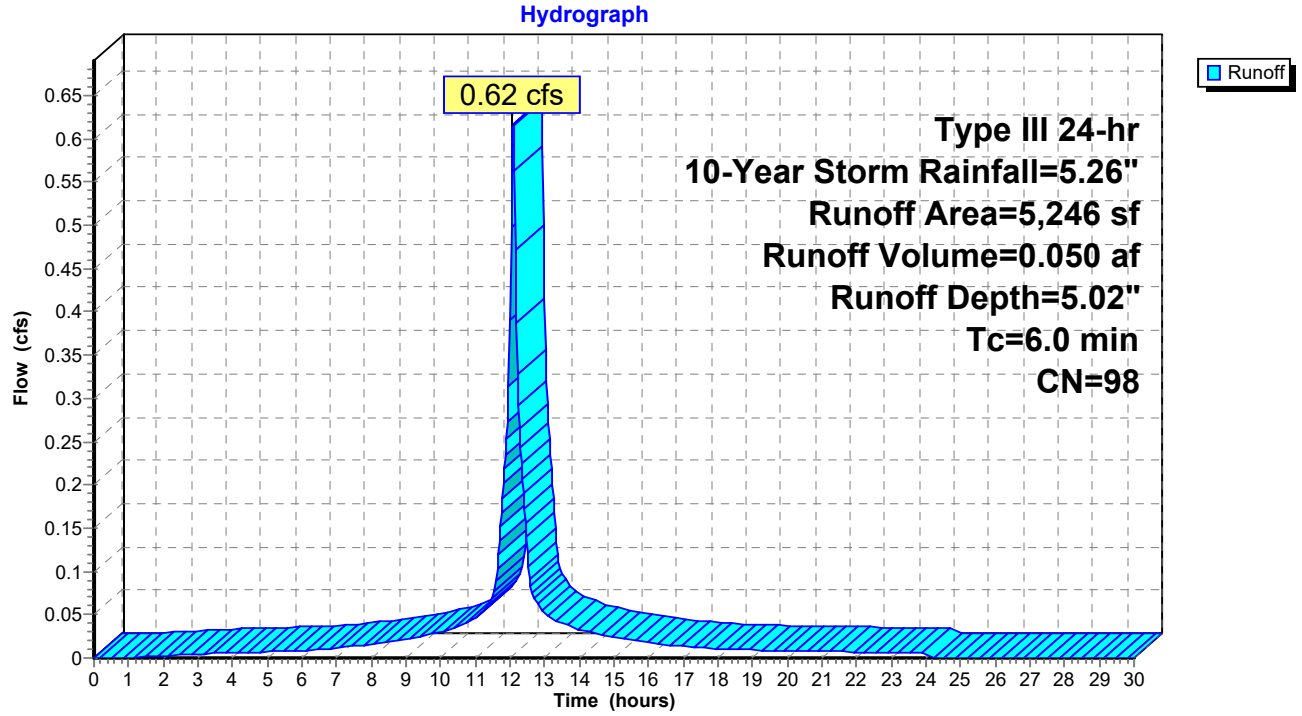
Runoff = 0.62 cfs @ 12.08 hrs, Volume= 0.050 af, Depth= 5.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Storm Rainfall=5.26"

Area (sf)	CN	Description
5,246	98	Roofs, HSG A
5,246		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Direct**

Subcatchment ROOF: WESTERN HALF ROOF AREA



Summary for Pond 1P: UNDERGROUND CHAMBERS

Inflow Area = 1.567 ac, 92.87% Impervious, Inflow Depth = 4.16" for 10-Year Storm event
Inflow = 7.03 cfs @ 12.09 hrs, Volume= 0.543 af
Outflow = 0.85 cfs @ 12.70 hrs, Volume= 0.543 af, Atten= 88%, Lag= 37.0 min
Discarded = 0.85 cfs @ 12.70 hrs, Volume= 0.543 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Peak Elev= 242.03' @ 12.70 hrs Surf.Area= 8,603 sf Storage= 8,647 cf

Plug-Flow detention time= 83.0 min calculated for 0.543 af (100% of inflow)
Center-of-Mass det. time= 82.9 min (859.2 - 776.3)

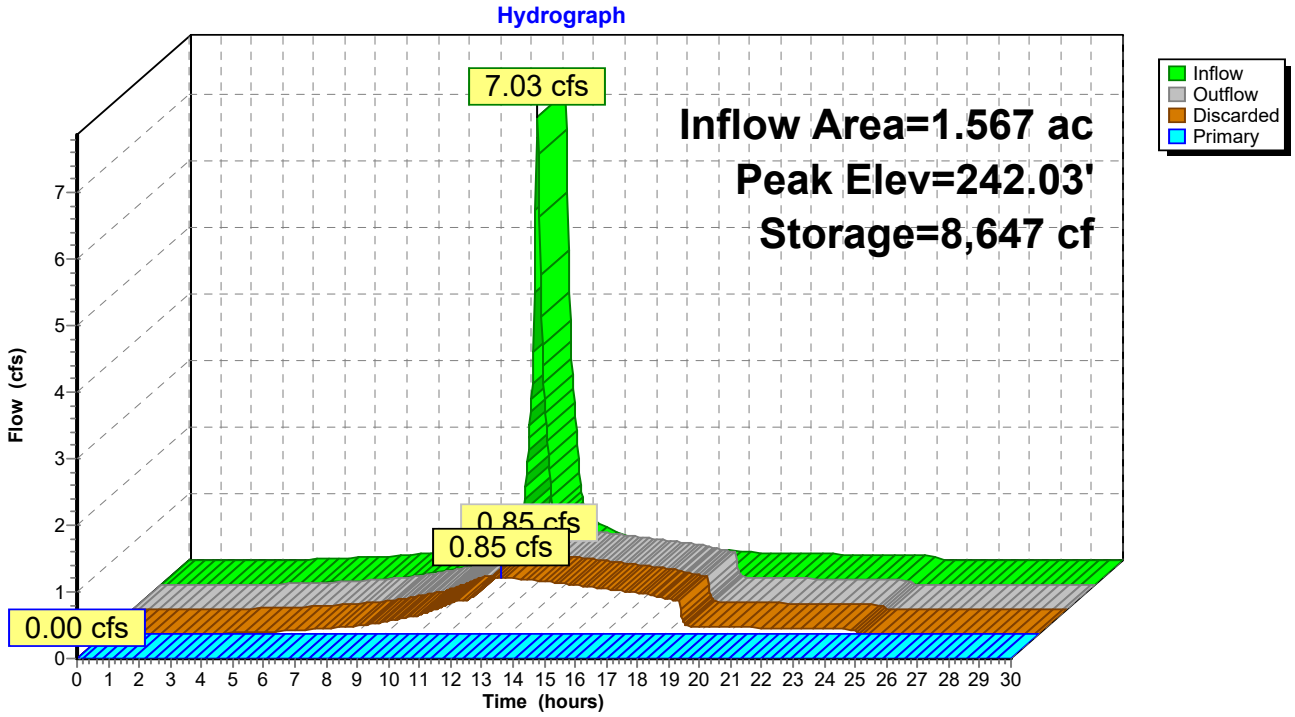
Volume	Invert	Avail.Storage	Storage Description
#1	240.50'	7,713 cf	**79.66'W x 108.00'L x 3.50'H Stone Surround** 30,111 cf Overall - 10,830 cf Embedded = 19,281 cf x 40.0% Voids
#2	241.00'	10,830 cf	**Cultec R-330XLHD** x 204 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 17 rows
		18,543 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	240.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 238.50'
#2	Primary	242.83'	**6.0" Round Culvert X 2.00** L= 21.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 242.83' / 242.00' S= 0.0395 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.85 cfs @ 12.70 hrs HW=242.03' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.85 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=240.50' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Pond 1P: UNDERGROUND CHAMBERS



Summary for Pond 2P: RAIN GARDEN

Inflow Area = 0.120 ac,100.00% Impervious, Inflow Depth = 5.02" for 10-Year Storm event
Inflow = 0.62 cfs @ 12.08 hrs, Volume= 0.050 af
Outflow = 0.31 cfs @ 12.23 hrs, Volume= 0.050 af, Atten= 50%, Lag= 8.8 min
Discarded = 0.07 cfs @ 12.23 hrs, Volume= 0.044 af
Primary = 0.24 cfs @ 12.23 hrs, Volume= 0.007 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Peak Elev= 247.08' @ 12.23 hrs Surf.Area= 1,104 sf Storage= 535 cf

Plug-Flow detention time= 43.0 min calculated for 0.050 af (100% of inflow)
Center-of-Mass det. time= 43.0 min (790.2 - 747.2)

Volume	Invert	Avail.Storage	Storage Description
#1	246.50'	1,829 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

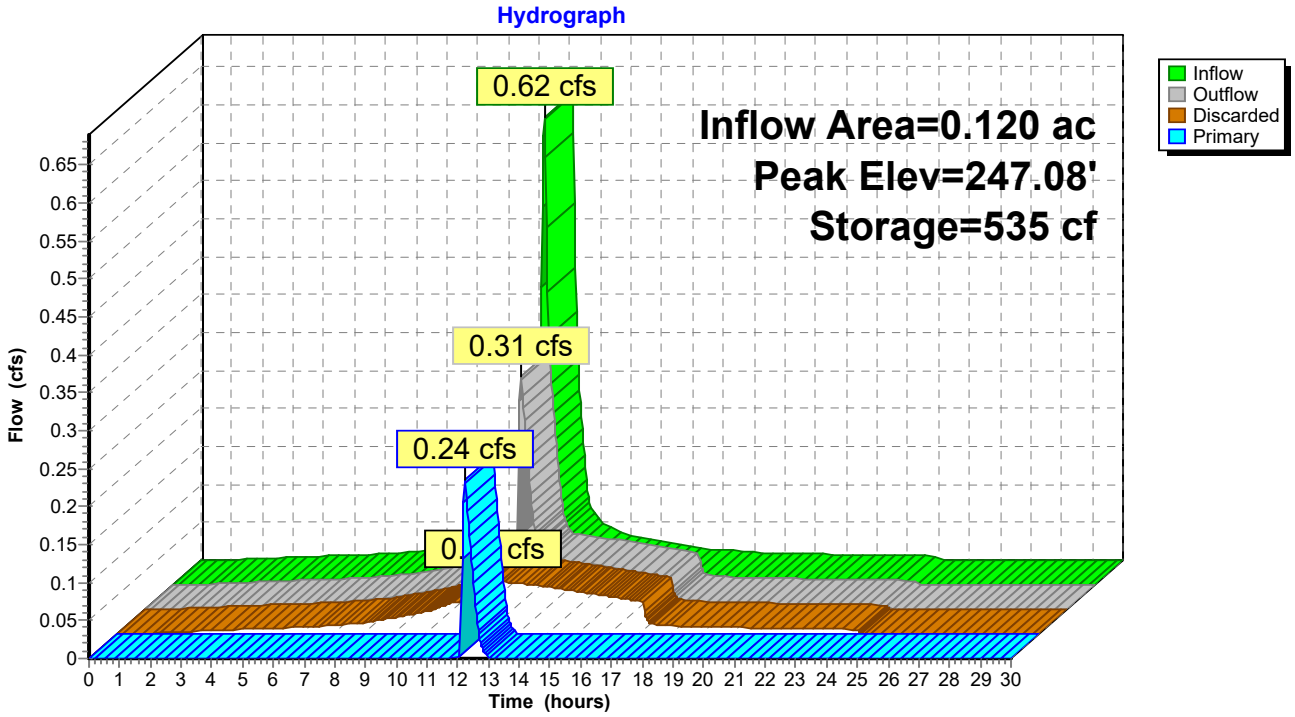
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
246.50	744	202.0	0	0	744
247.00	1,056	214.0	448	448	1,155
248.00	1,734	238.0	1,381	1,829	2,047

Device	Routing	Invert	Outlet Devices
#1	Discarded	246.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 243.45'
#2	Primary	247.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.07 cfs @ 12.23 hrs HW=247.08' (Free Discharge)
↑**1=Exfiltration** (Controls 0.07 cfs)

Primary OutFlow Max=0.23 cfs @ 12.23 hrs HW=247.08' (Free Discharge)
↑**2=Orifice/Grate** (Weir Controls 0.23 cfs @ 0.93 fps)

Pond 2P: RAIN GARDEN

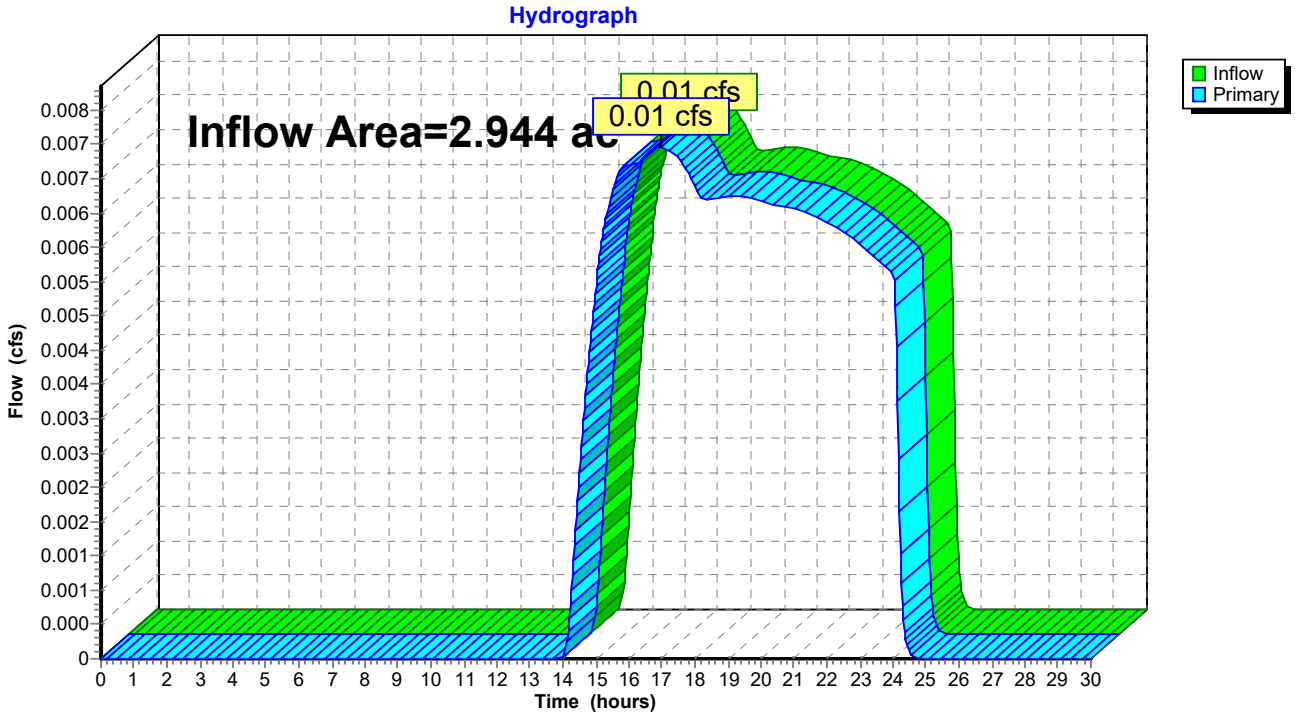


Summary for Link 1S: OFF-SITE RUNOFF - WETLANDS

Inflow Area = 2.944 ac, 49.43% Impervious, Inflow Depth = 0.02" for 10-Year Storm event
Inflow = 0.01 cfs @ 16.94 hrs, Volume= 0.005 af
Primary = 0.01 cfs @ 16.94 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs

Link 1S: OFF-SITE RUNOFF - WETLANDS



Summary for Subcatchment 1A: PAVEMENT & HALF BUILDING

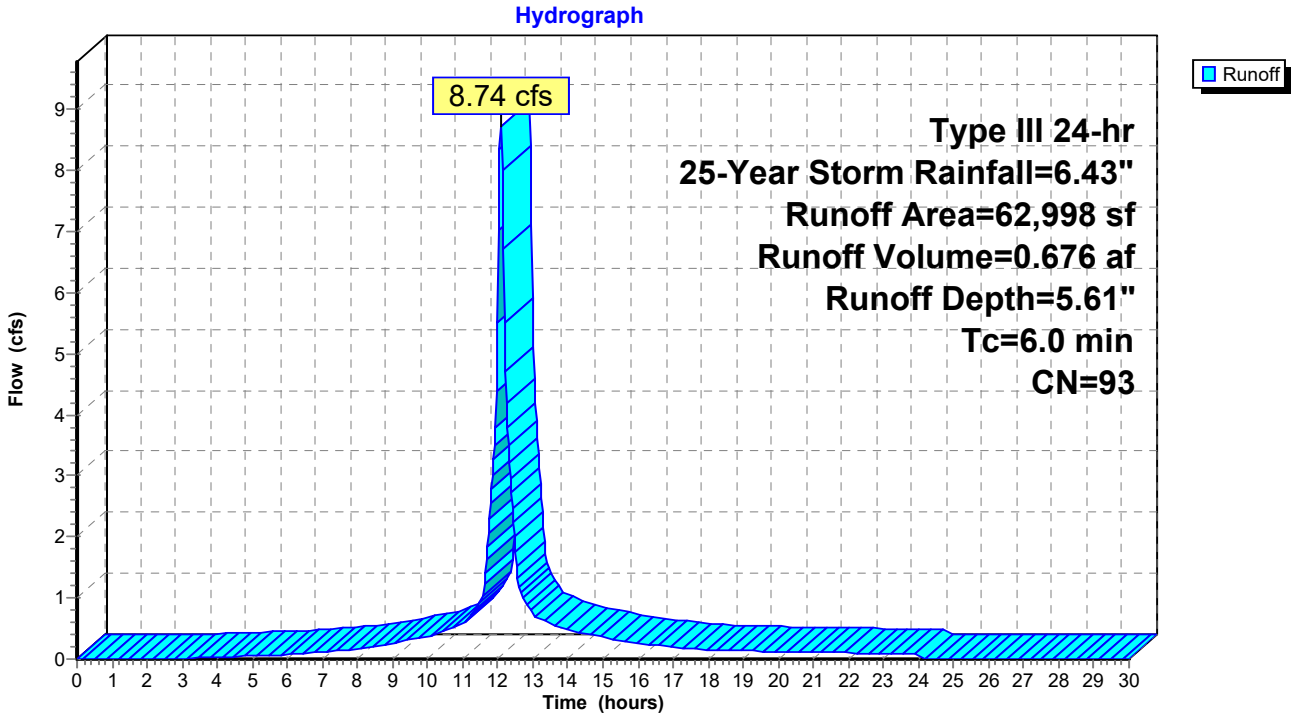
Runoff = 8.74 cfs @ 12.08 hrs, Volume= 0.676 af, Depth= 5.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Storm Rainfall=6.43"

Area (sf)	CN	Description
6,062	98	Roofs, HSG A
52,070	98	Paved parking, HSG A
4,866	39	>75% Grass cover, Good, HSG A
62,998	93	Weighted Average
4,866		7.72% Pervious Area
58,132		92.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, DIRECT**

Subcatchment 1A: PAVEMENT & HALF BUILDING



Summary for Subcatchment 1B: LANDSCAPE & WOODS

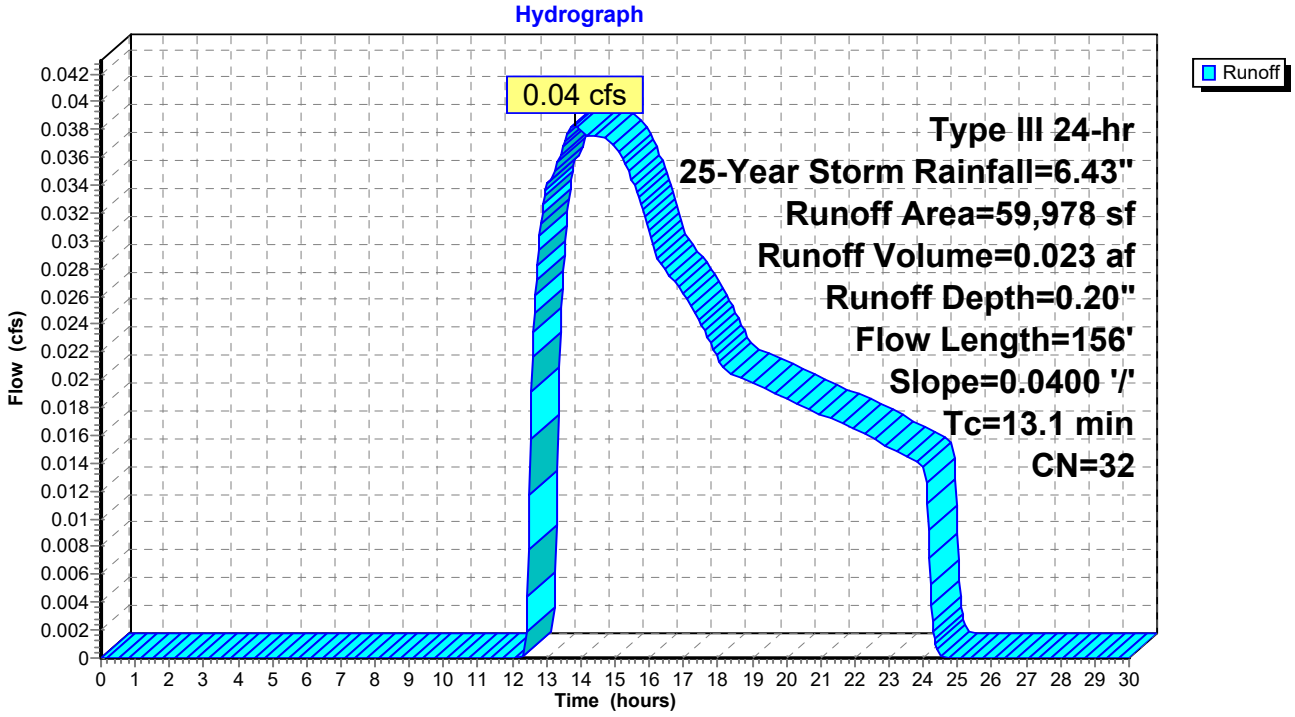
Runoff = 0.04 cfs @ 13.84 hrs, Volume= 0.023 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Storm Rainfall=6.43"

Area (sf)	CN	Description
12,949	39	>75% Grass cover, Good, HSG A
47,029	30	Woods, Good, HSG A
59,978	32	Weighted Average
59,978		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	156	0.0400	0.20		**Lag/CN Method,**

Subcatchment 1B: LANDSCAPE & WOODS



Summary for Subcatchment ROOF: WESTERN HALF ROOF AREA

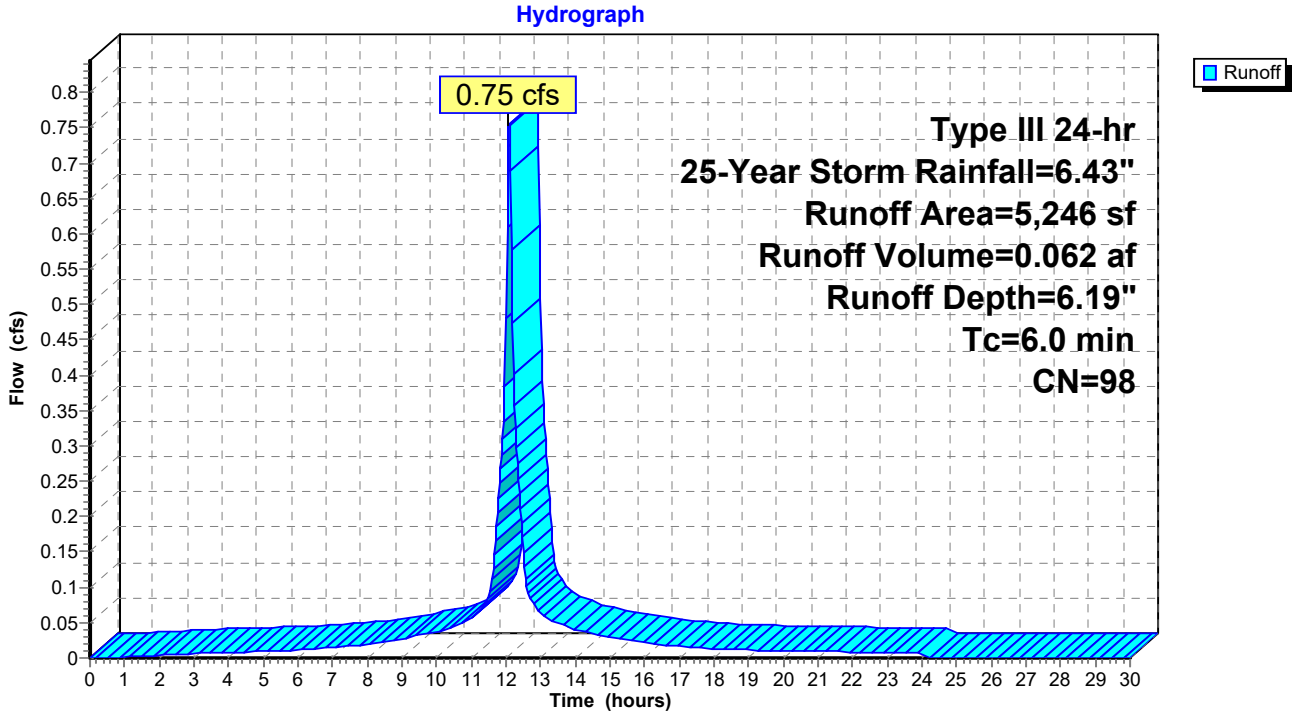
Runoff = 0.75 cfs @ 12.08 hrs, Volume= 0.062 af, Depth= 6.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Storm Rainfall=6.43"

Area (sf)	CN	Description
5,246	98	Roofs, HSG A
5,246		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Direct**

Subcatchment ROOF: WESTERN HALF ROOF AREA



Summary for Pond 1P: UNDERGROUND CHAMBERS

Inflow Area = 1.567 ac, 92.87% Impervious, Inflow Depth = 5.27" for 25-Year Storm event
Inflow = 8.94 cfs @ 12.09 hrs, Volume= 0.688 af
Outflow = 0.96 cfs @ 12.79 hrs, Volume= 0.688 af, Atten= 89%, Lag= 41.9 min
Discarded = 0.96 cfs @ 12.79 hrs, Volume= 0.688 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Peak Elev= 242.49' @ 12.79 hrs Surf.Area= 8,603 sf Storage= 11,639 cf

Plug-Flow detention time= 105.2 min calculated for 0.688 af (100% of inflow)
Center-of-Mass det. time= 105.1 min (875.6 - 770.5)

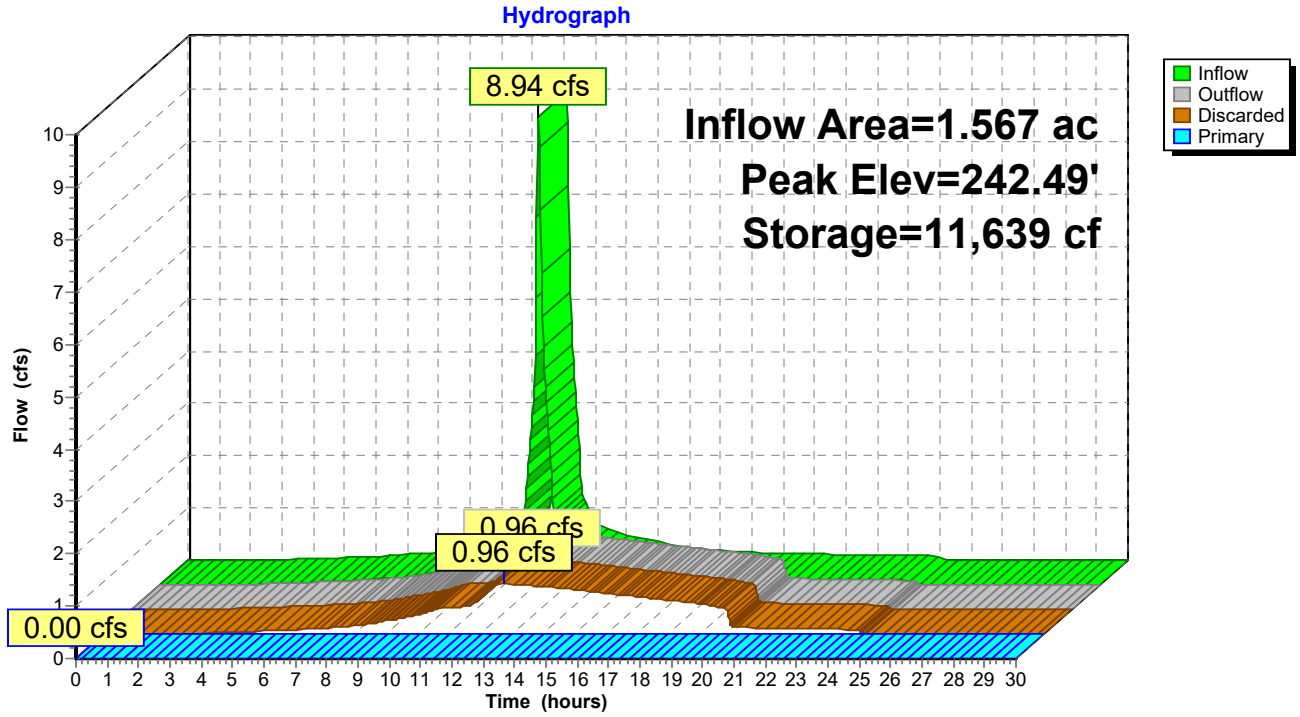
Volume	Invert	Avail.Storage	Storage Description
#1	240.50'	7,713 cf	**79.66'W x 108.00'L x 3.50'H Stone Surround** 30,111 cf Overall - 10,830 cf Embedded = 19,281 cf x 40.0% Voids
#2	241.00'	10,830 cf	**Cultec R-330XLHD** x 204 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 17 rows
		18,543 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	240.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 238.50'
#2	Primary	242.83'	**6.0" Round Culvert X 2.00** L= 21.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 242.83' / 242.00' S= 0.0395 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.96 cfs @ 12.79 hrs HW=242.49' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.96 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=240.50' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Pond 1P: UNDERGROUND CHAMBERS



Summary for Pond 2P: RAIN GARDEN

Inflow Area = 0.120 ac,100.00% Impervious, Inflow Depth = 6.19" for 25-Year Storm event
Inflow = 0.75 cfs @ 12.08 hrs, Volume= 0.062 af
Outflow = 0.53 cfs @ 12.16 hrs, Volume= 0.062 af, Atten= 29%, Lag= 4.8 min
Discarded = 0.07 cfs @ 12.16 hrs, Volume= 0.050 af
Primary = 0.46 cfs @ 12.16 hrs, Volume= 0.013 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Peak Elev= 247.13' @ 12.16 hrs Surf.Area= 1,132 sf Storage= 586 cf

Plug-Flow detention time= 41.1 min calculated for 0.062 af (100% of inflow)
Center-of-Mass det. time= 41.0 min (785.2 - 744.1)

Volume	Invert	Avail.Storage	Storage Description
#1	246.50'	1,829 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

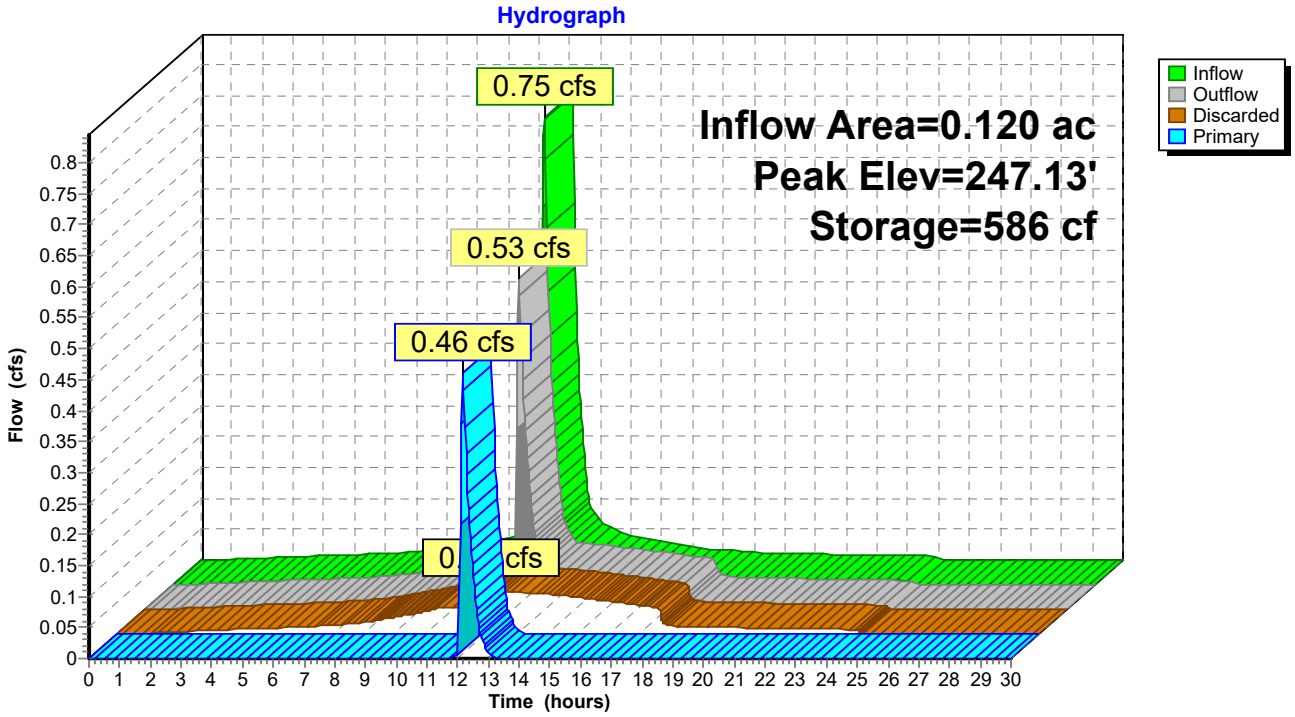
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
246.50	744	202.0	0	0	744
247.00	1,056	214.0	448	448	1,155
248.00	1,734	238.0	1,381	1,829	2,047

Device	Routing	Invert	Outlet Devices
#1	Discarded	246.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 243.45'
#2	Primary	247.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.07 cfs @ 12.16 hrs HW=247.12' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.07 cfs)

Primary OutFlow Max=0.45 cfs @ 12.16 hrs HW=247.12' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.45 cfs @ 1.15 fps)

Pond 2P: RAIN GARDEN

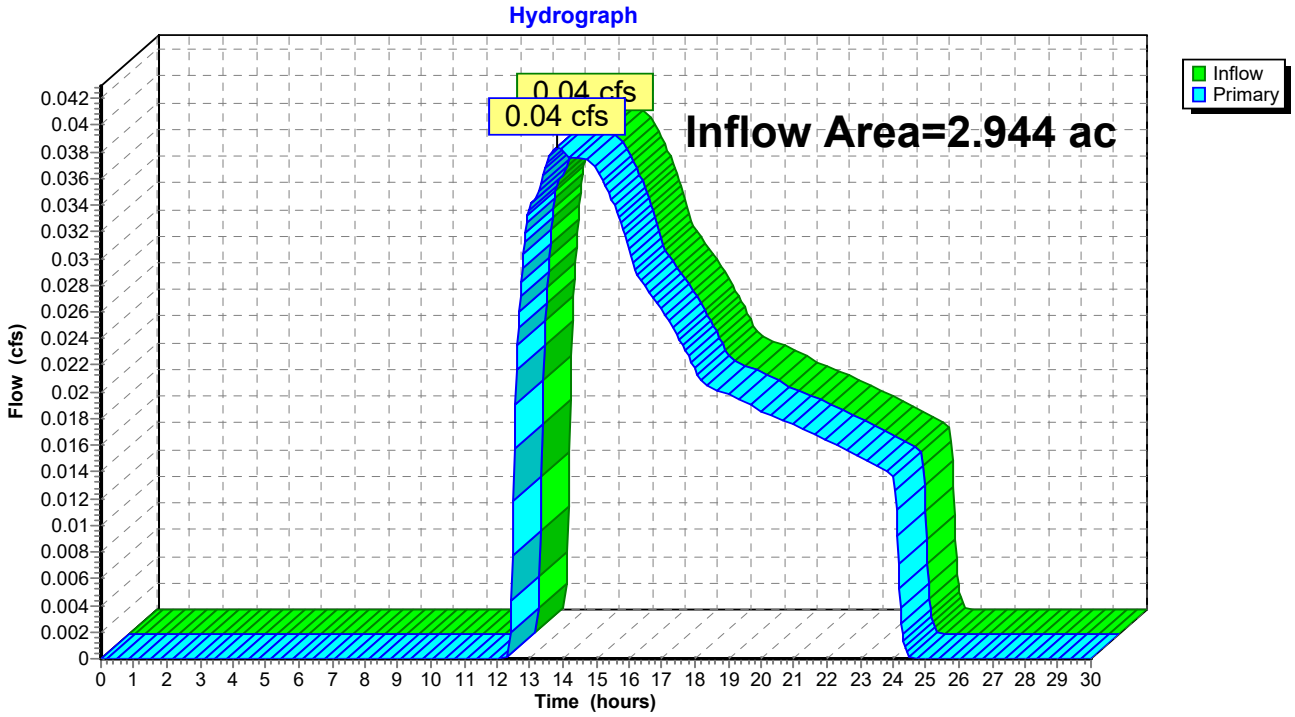


Summary for Link 1S: OFF-SITE RUNOFF - WETLANDS

Inflow Area = 2.944 ac, 49.43% Impervious, Inflow Depth = 0.09" for 25-Year Storm event
Inflow = 0.04 cfs @ 13.84 hrs, Volume= 0.023 af
Primary = 0.04 cfs @ 13.84 hrs, Volume= 0.023 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs

Link 1S: OFF-SITE RUNOFF - WETLANDS



Summary for Subcatchment 1A: PAVEMENT & HALF BUILDING

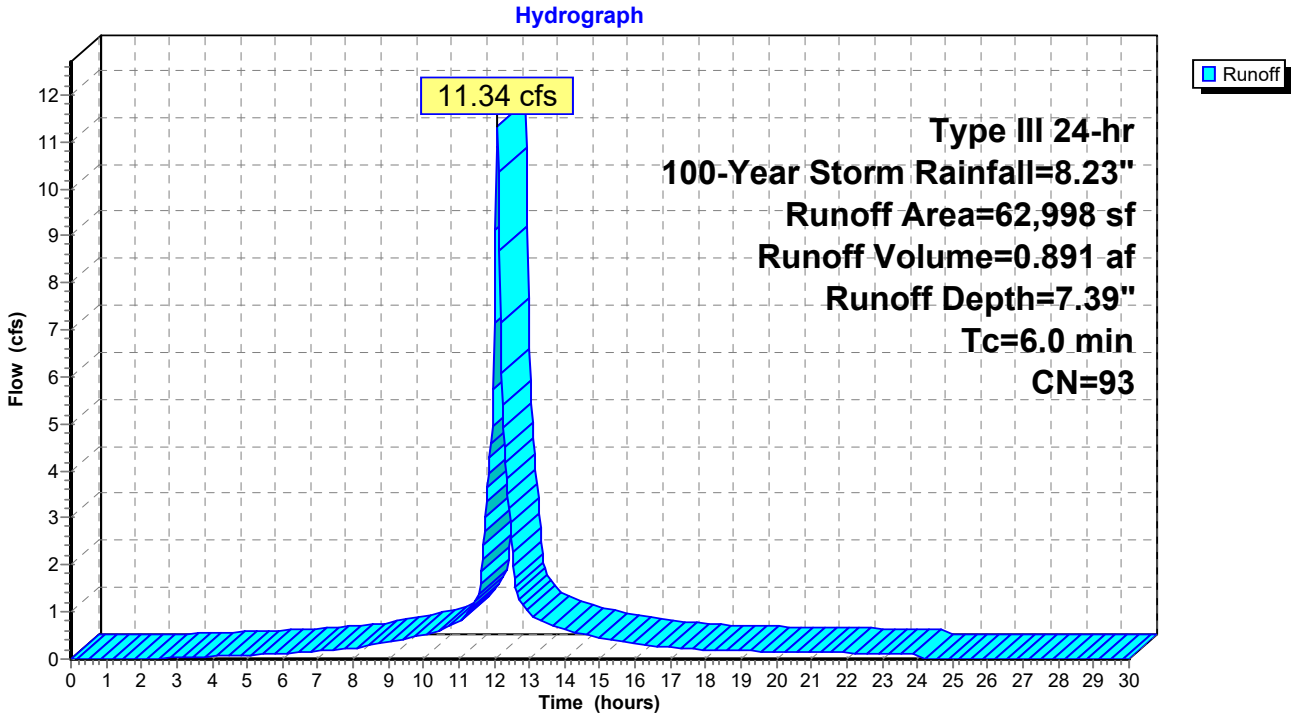
Runoff = 11.34 cfs @ 12.08 hrs, Volume= 0.891 af, Depth= 7.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Storm Rainfall=8.23"

Area (sf)	CN	Description
6,062	98	Roofs, HSG A
52,070	98	Paved parking, HSG A
4,866	39	>75% Grass cover, Good, HSG A
62,998	93	Weighted Average
4,866		7.72% Pervious Area
58,132		92.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, DIRECT**

Subcatchment 1A: PAVEMENT & HALF BUILDING



Summary for Subcatchment 1B: LANDSCAPE & WOODS

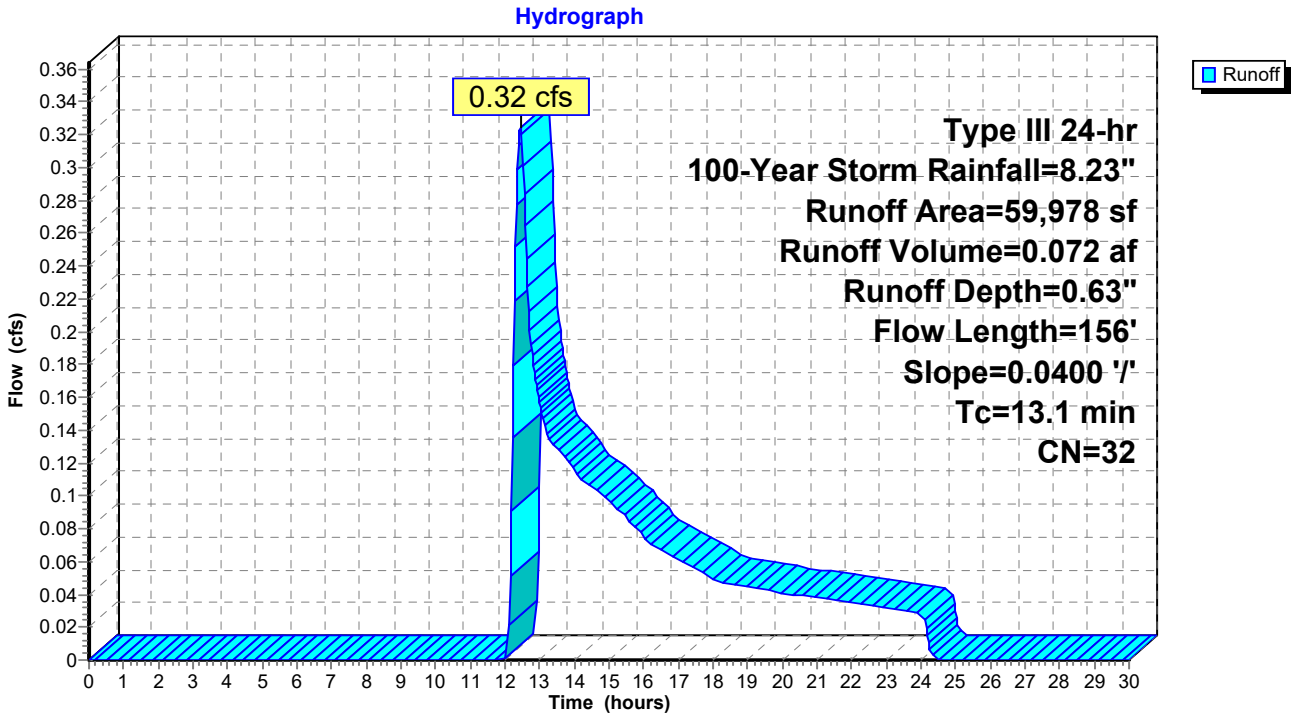
Runoff = 0.32 cfs @ 12.45 hrs, Volume= 0.072 af, Depth= 0.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Storm Rainfall=8.23"

Area (sf)	CN	Description
12,949	39	>75% Grass cover, Good, HSG A
47,029	30	Woods, Good, HSG A
59,978	32	Weighted Average
59,978		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	156	0.0400	0.20		**Lag/CN Method,**

Subcatchment 1B: LANDSCAPE & WOODS



Summary for Subcatchment ROOF: WESTERN HALF ROOF AREA

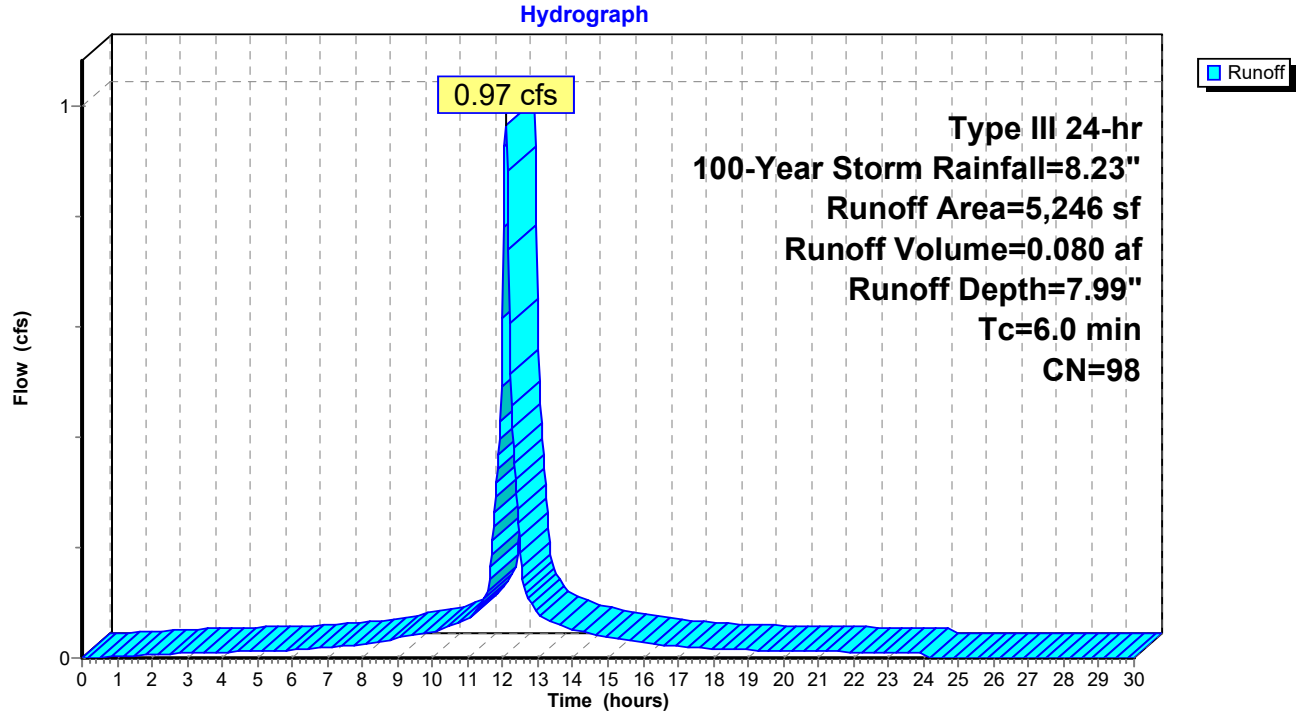
Runoff = 0.97 cfs @ 12.08 hrs, Volume= 0.080 af, Depth= 7.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Storm Rainfall=8.23"

Area (sf)	CN	Description
5,246	98	Roofs, HSG A
5,246		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Direct**

Subcatchment ROOF: WESTERN HALF ROOF AREA



Summary for Pond 1P: UNDERGROUND CHAMBERS

Inflow Area = 1.567 ac, 92.87% Impervious, Inflow Depth = 6.99" for 100-Year Storm event
Inflow = 11.99 cfs @ 12.09 hrs, Volume= 0.913 af
Outflow = 1.76 cfs @ 12.58 hrs, Volume= 0.913 af, Atten= 85%, Lag= 29.7 min
Discarded = 1.14 cfs @ 12.58 hrs, Volume= 0.875 af
Primary = 0.62 cfs @ 12.58 hrs, Volume= 0.038 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Peak Elev= 243.25' @ 12.58 hrs Surf.Area= 8,603 sf Storage= 15,847 cf

Plug-Flow detention time= 121.8 min calculated for 0.912 af (100% of inflow)
Center-of-Mass det. time= 121.7 min (885.7 - 764.0)

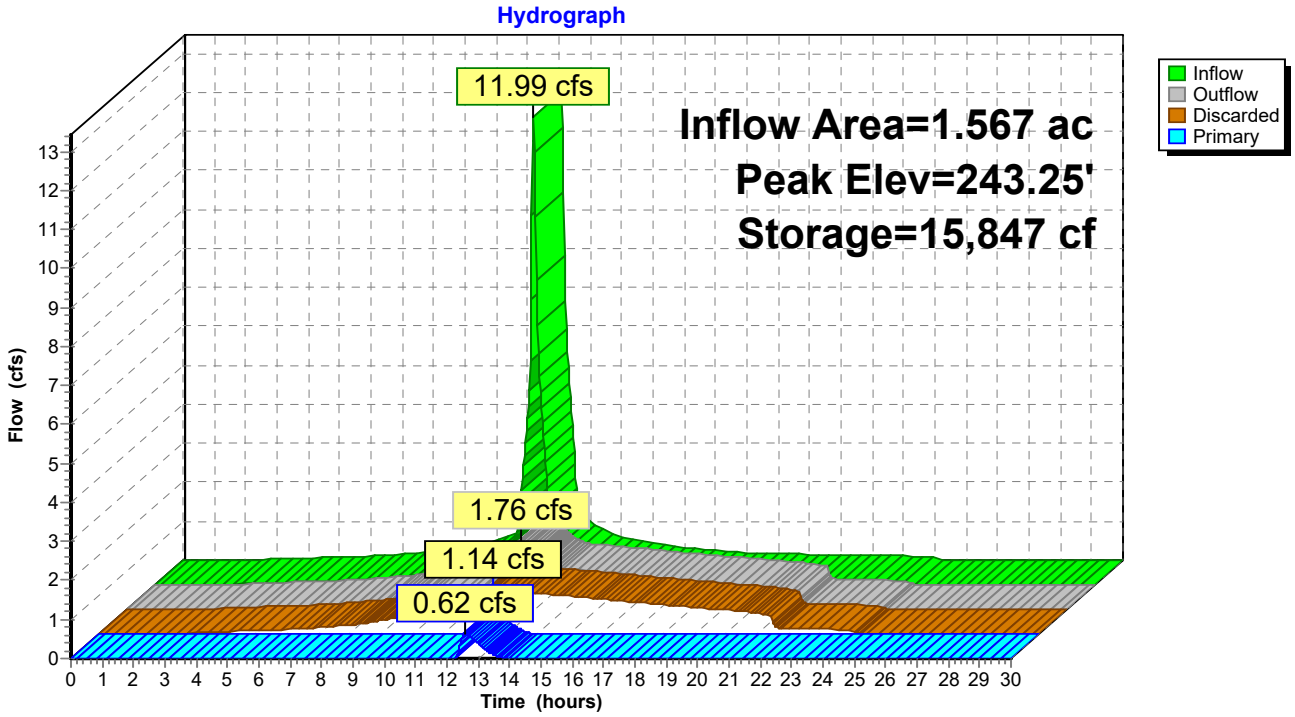
Volume	Invert	Avail.Storage	Storage Description
#1	240.50'	7,713 cf	**79.66'W x 108.00'L x 3.50'H Stone Surround** 30,111 cf Overall - 10,830 cf Embedded = 19,281 cf x 40.0% Voids
#2	241.00'	10,830 cf	**Cultec R-330XLHD** x 204 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 17 rows
		18,543 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	240.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 238.50'
#2	Primary	242.83'	**6.0" Round Culvert X 2.00** L= 21.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 242.83' / 242.00' S= 0.0395 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=1.14 cfs @ 12.58 hrs HW=243.25' (Free Discharge)
↑—**1=Exfiltration** (Controls 1.14 cfs)

Primary OutFlow Max=0.62 cfs @ 12.58 hrs HW=243.25' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.62 cfs @ 1.75 fps)

Pond 1P: UNDERGROUND CHAMBERS



Summary for Pond 2P: RAIN GARDEN

Inflow Area = 0.120 ac,100.00% Impervious, Inflow Depth = 7.99" for 100-Year Storm event
Inflow = 0.97 cfs @ 12.08 hrs, Volume= 0.080 af
Outflow = 0.83 cfs @ 12.13 hrs, Volume= 0.080 af, Atten= 14%, Lag= 2.9 min
Discarded = 0.08 cfs @ 12.13 hrs, Volume= 0.058 af
Primary = 0.76 cfs @ 12.13 hrs, Volume= 0.022 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs
Peak Elev= 247.18' @ 12.13 hrs Surf.Area= 1,163 sf Storage= 643 cf

Plug-Flow detention time= 39.6 min calculated for 0.080 af (100% of inflow)
Center-of-Mass det. time= 39.5 min (780.4 - 740.9)

Volume	Invert	Avail.Storage	Storage Description
#1	246.50'	1,829 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

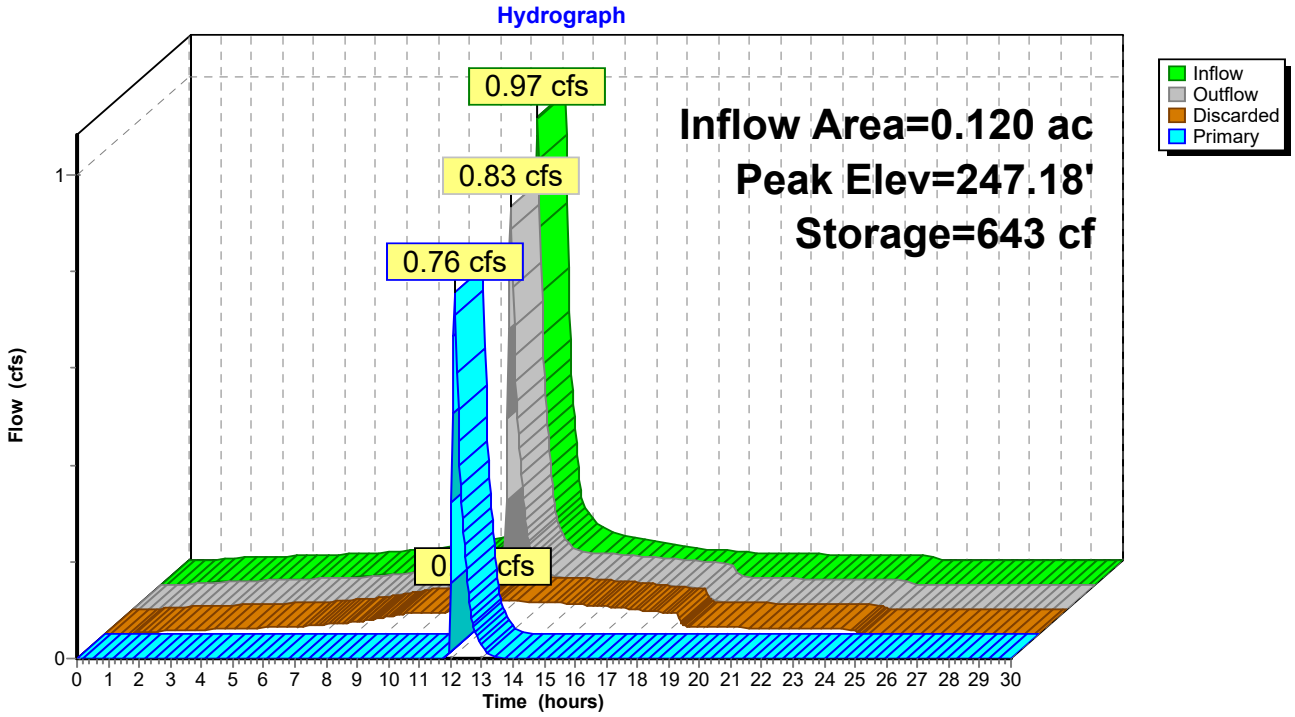
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
246.50	744	202.0	0	0	744
247.00	1,056	214.0	448	448	1,155
248.00	1,734	238.0	1,381	1,829	2,047

Device	Routing	Invert	Outlet Devices
#1	Discarded	246.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 243.45'
#2	Primary	247.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.08 cfs @ 12.13 hrs HW=247.17' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.08 cfs)

Primary OutFlow Max=0.75 cfs @ 12.13 hrs HW=247.17' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.75 cfs @ 1.36 fps)

Pond 2P: RAIN GARDEN

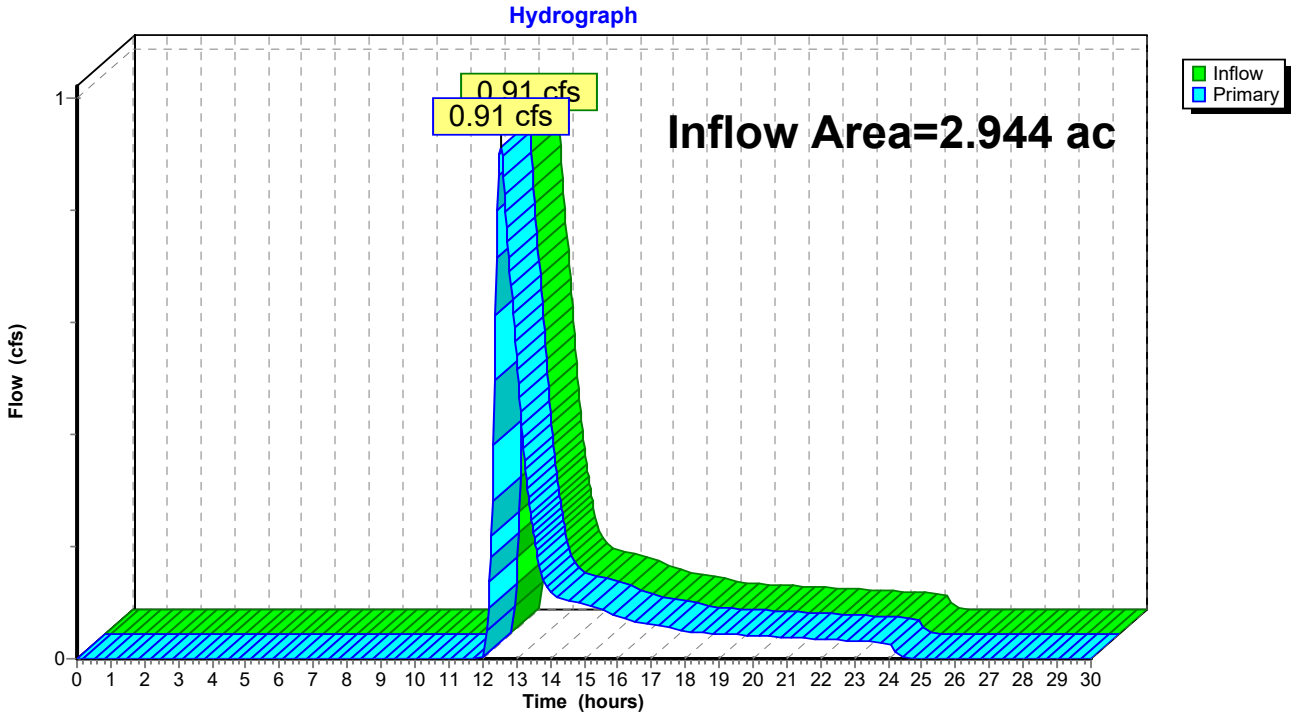


Summary for Link 1S: OFF-SITE RUNOFF - WETLANDS

Inflow Area = 2.944 ac, 49.43% Impervious, Inflow Depth = 0.45" for 100-Year Storm event
Inflow = 0.91 cfs @ 12.55 hrs, Volume= 0.110 af
Primary = 0.91 cfs @ 12.55 hrs, Volume= 0.110 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs

Link 1S: OFF-SITE RUNOFF - WETLANDS



Appendix F

Additional Stormwater Design Drainage Calculations

TABLE NO. 3
STORMWATER MANAGEMENT CALCULATIONS
PROPOSED ETS EQUIPMENT RENTAL FACILITY
#39 ALDER STREET
MEDWAY, MA

STANDARD 3 - RECHARGE
REQUIRED RECHARGE VOLUME
RECHARGE VOLUME (Rv)

Existing Impervious Area =	238	s.f.
Proposed Impervious Area =	**63,378**	**s.f.**

Impervious Area (s.f.)	**Rv (cf)**	**Soil Type - Type A = 0.60 inches**
Impervious Area s.f. x (0.60") x (1'/12")	**3,169**	c.f.

Proposed Underground Infiltration Chambers (Pond 1P)

Storage Volume =	13,470	c.f.	(Elev. 242.83 = 2-6" Diam. Outlet Pipes)

STANDARD 4 - WATER QUALITY

Impervious Area (s.f.)	**WQv (cf)**	**Zone II = 1" Runoff**
Impervious Area s.f. x (1") x (1'/12")	**5,282**	**c.f.**
Proposed Storage in Chambers =	**13,470**	**c.f.**

SUBCATCHMENT 1A - Building & Paved Storage/ Parking Areas

TSS Removal Calculation (CB-1)		**TSS Removal**	**TSS Remaining**	
1. Catch Basin	25%	0.25	**0.75**	
2. Hydrodome Water Quality Unit	83%	0.83	**0.13**	
3. Underground Infiltration System	80%	0.80	**0.03**	
		TSS Removal Efficiency =		**0.97**

TSS Removal Calculation (WQ-2)		**TSS Removal**	**TSS Remaining**	
1. Hydrodome Water Quality Unit	88%	0.88	**0.12**	
2. Underground Infiltration System	80%	0.80	**0.02**	
		TSS Removal Efficiency =		**0.98**

TSS Removal Calculation (WQ-3)		**TSS Removal**	**TSS Remaining**	
1. Hydrodome Water Quality Unit	87%	0.87	**0.13**	
2. Underground Infiltration System	80%	0.80	**0.03**	
		TSS Removal Efficiency =		**0.97**

Drawdown (Td) = Rv / k A	**3.06**	**hours**	< 72 Hours OK
Recharge Volume (Rv) =	5,282	c.f.	
Permeability (k) =	2.41	in/hr	
Bottom Area (A) =	8,603	s.f.	

Stage-Area-Storage for Pond 1P: UNDERGROUND CHAMBERS

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
240.50	**8,603**	0
240.55	8,603	172
240.60	8,603	344
240.65	8,603	516
240.70	8,603	688
240.75	8,603	860
240.80	8,603	1,032
240.85	8,603	1,204
240.90	8,603	1,377
240.95	8,603	1,549
241.00	8,603	1,721
241.05	8,603	2,066
241.10	8,603	2,411
241.15	8,603	2,754
241.20	8,603	3,097
241.25	8,603	3,439
241.30	8,603	3,781
241.35	8,603	4,122
241.40	8,603	4,463
241.45	8,603	4,804
241.50	8,603	5,144
241.55	8,603	5,484
241.60	8,603	5,822
241.65	8,603	6,158
241.70	8,603	6,492
241.75	8,603	6,824
241.80	8,603	7,156
241.85	8,603	7,487
241.90	8,603	7,817
241.95	8,603	8,147
242.00	8,603	8,476
242.05	8,603	8,805
242.10	8,603	9,133
242.15	8,603	9,460
242.20	8,603	9,786
242.25	8,603	10,110
242.30	8,603	10,431
242.35	8,603	10,749
242.40	8,603	11,063
242.45	8,603	11,375
242.50	8,603	11,684
242.55	8,603	11,990
242.60	8,603	12,293
242.65	8,603	12,592
242.70	8,603	12,889
242.75	8,603	13,181
242.80	8,603	13,470
242.85	8,603	13,755
242.90	8,603	14,035
242.95	8,603	14,310
243.00	8,603	14,580
243.05	8,603	14,844
243.10	8,603	15,102
243.15	8,603	15,352
243.20	8,603	15,594
243.25	8,603	15,826
243.30	8,603	16,046
243.35	8,603	16,256
243.40	8,603	16,455
243.45	8,603	16,643
243.50	8,603	16,822
243.55	8,603	16,994
243.60	8,603	17,166
243.65	8,603	17,338
243.70	8,603	17,510
243.75	8,603	17,682
243.80	8,603	17,854
243.85	8,603	18,026
243.90	8,603	18,198
243.95	8,603	18,371
244.00	8,603	**18,543**

Two (2) 6" Outlet Pipes: Inv.=242.83

RIP RAP SIZING CALCULATIONS
PROPOSED ETS EQUIPMENT RENTAL FACILITY
#39 ALDER STREET
MEDWAY, MA

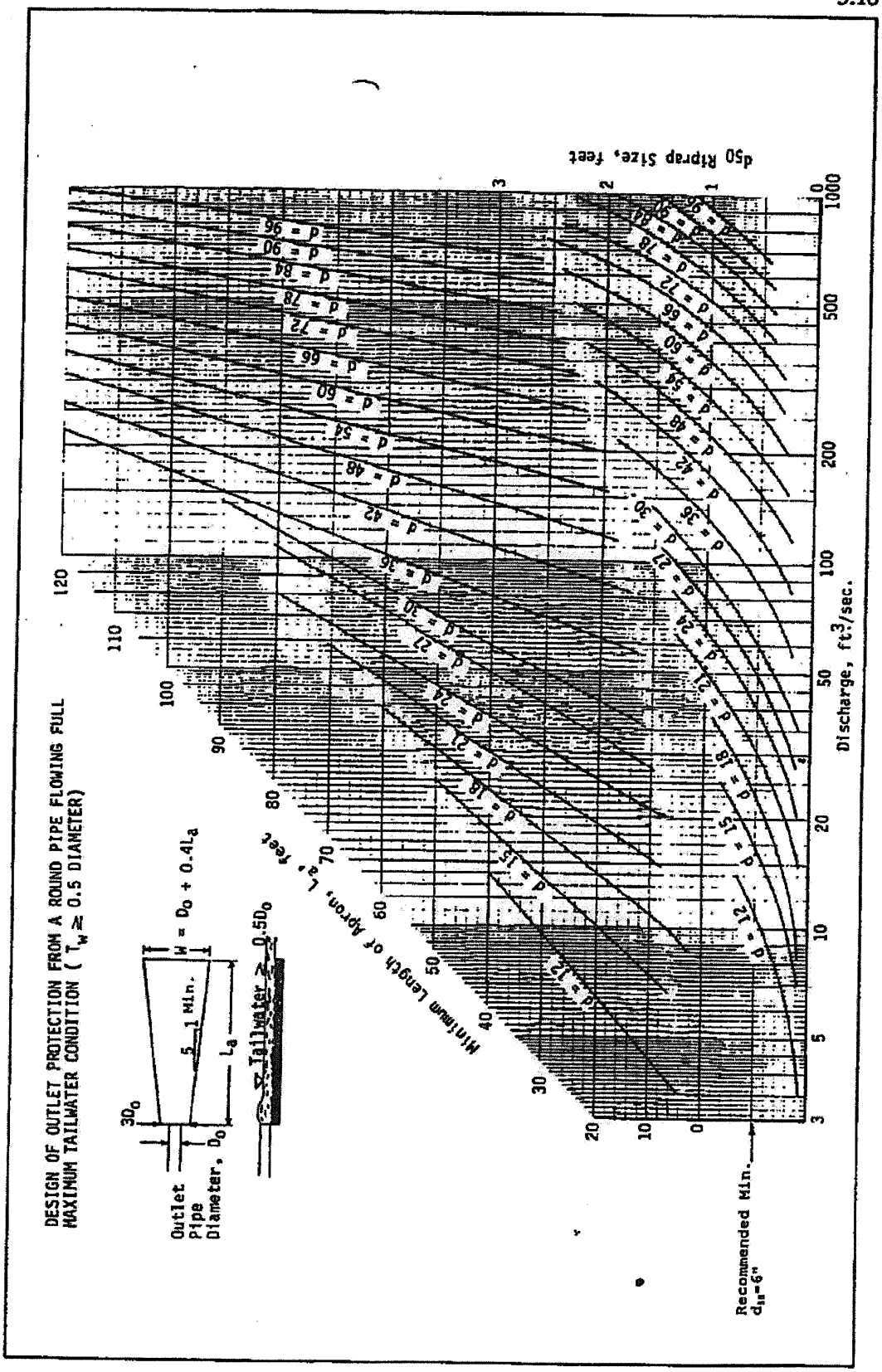
STANDARD 1 - DRAINAGE OUTFALL RIPRAP APRON SIZING

INFILTRATION BASIN #1	Flow Rate (cfs)	Min. Stone Diam. (in)*	Apron Length (ft)*	Apron Width (Upstream)*	Apron Width (Downstream)*
INFILTRATION CHAMBERS (8" HDPE)	0.76	6	5	2	6

*Minimum Stone Diameter, Riprap Apron Length, and Riprap Apron Width were determined by USDA-NRCS Outlet Protection Spec 3.18, dated 1992. See attached nomographs from applicable sections.

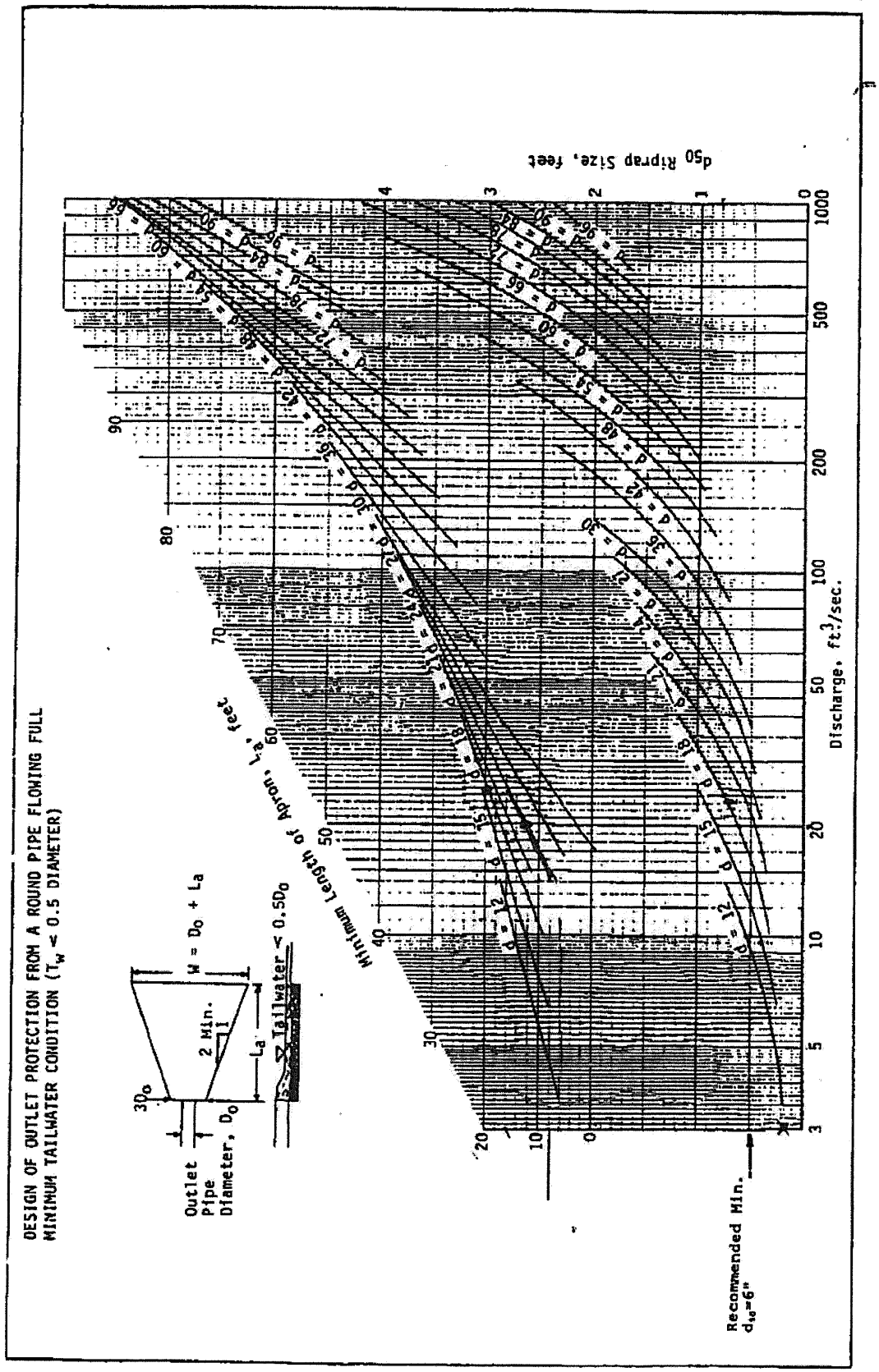
**All outlets designed for 100-year storm flow conditions. Outlets assumed to be under water during design storm flows, therefore, maximum tailwater design calculations were used.

***Outlets assumed to be discharging to grassy slope with no tailwater during design storm flows, therefore, minimum tailwater design calculations were used.



Source: USDA-SCS

Plate 3.18-4



Source: USDA-SCS

Plate 3.18-3

Groundwater Mounding Analysis - Hantush Method

Project:	ETS Equipment Rental Facility	**Project #:**	2020-149
Performed By:	RL	**Description:**	Pond 1P
Checked By:	DTF	**Calculated Mound Height:**	0.5 **feet**

Input Parameters (input only shaded areas)**:**

Recharge Period	t =	0.3	days	Time to equilibrium (Dewater in 3 hrs)
Width of Field	W =	79.66	feet	
Length of Field	L =	108	feet	
Hydraulic Conductivity	K =	4.82	ft/day	**2.41 in / hr - Rawls Rate Loamy Sand**
Specific Yield	V =	0.25	ft^3/ft^3	Loamy Sand = 0.25 See Specific Yield Tab
Saturated Thickness	D =	19.66	feet	**ESHGW @ 64", Assumed bed rock depth 25'**
Daily Flow	Q =	24,669	gpd	**3298 c.f. = Required Recharge Volume**

Calculated Parameters:

1/2 width	a =	39.83	feet
1/2 length	b =	54	feet
Recharge Rate	j =	0.38	ft/day

$$\gamma = \frac{KD}{V} = \quad 379.0 \quad ft^2/day$$

Dimensionless width $$\alpha = \frac{a}{\sqrt{4\gamma t}} = \quad 1.8676$$

Dimensionless length $$\beta = \frac{b}{\sqrt{4\gamma t}} = \quad 2.5320$$

Solution:

From Table 1of Hantush (1967), attached:

Function S*(a , b) = 0.9983

Water Table + Mound $$h_m = \sqrt{h_i^2 + \left[\frac{2j}{K}\lambda t \cdot S^*(\alpha,\beta)\right]}$$

h_m = 20.1 feet

Mound Height =	**h_m - D =**	**0.5**	**feet**

Reference: Hantush, M.S. 1967. "Growth and Decay of Groundwater Mounds in Response to Uniform Percolation."
Water Resources Research, 3, pp. 227-234.

RATIONAL METHOD PIPE DESIGN WORKSHEET

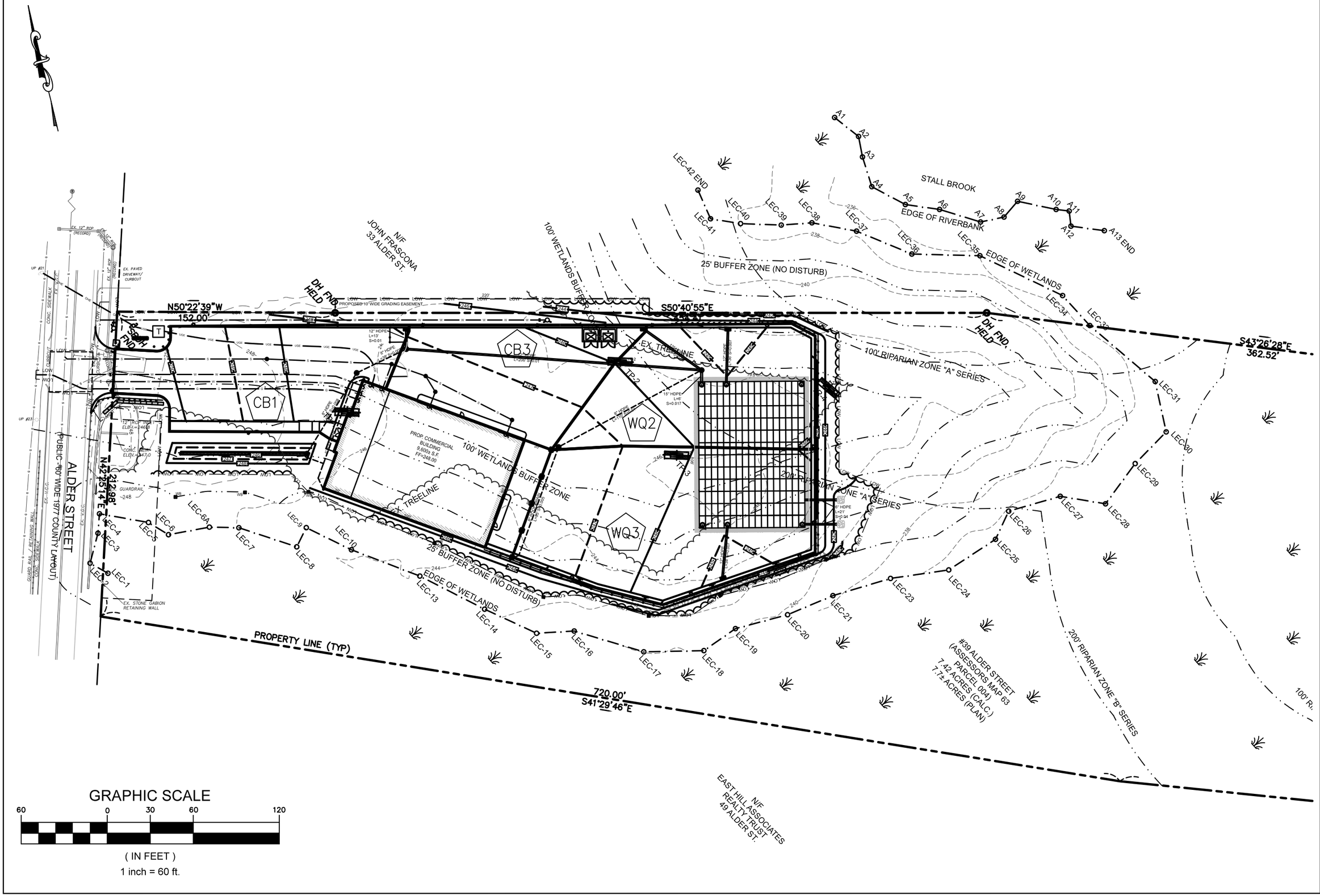
Proposed Commercial Building
#39 Alder Street
Medway, MA

LOCATION	PIPE SEGMENT From	To	INCREMENTAL AREA DESIGNATION	A (Acres)	Total A	C	C*A	Sum (C*A)	FLOW TIME (min.) To Inlet	In Chan.	Tot.	25-Yr I (in/hr)	25-Yr Q (cfs)	DESIGN CONDITIONS Pipe Diam (in.)	Length (ft)	Slope (%)	Q-full (cfs)	V-Full (fps)	Design (25-Yr) Depth Peak (in.)	V-Peak (fps)	Inverts Up	Down	Remarks
CB-1 to Underground Chambers																							
dbl grate	CB-1	DMH-2		0.273		0.89	**0.24**		5		5	6.42	**1.56**	12	13	0.010	**3.87**	4.93	4.8	1.99	243.4	243.27	CB-1 Rim =246.90
	1/2 Roof	DMH-2		0.138		0.90	**0.12**		5		5	6.42	**0.80**	8	123	0.014	**1.56**	4.49	4.1	2.29	245.50	243.75	
	DMH-2	WQ-1			0.411			**0.37**	5		5	6.42	**2.36**	12	168	0.010	**3.86**	4.91	7.3	3.00	243.17	241.50	DMH-2 Rim=246.80
	1/2 Roof	WQ-1		0.138		0.90	**0.12**					6.42	**0.80**	8	150	0.027	**2.14**	6.14	3.0	2.29	245.50	241.50	
dbl grate	CB-3	WQ-1		0.231		0.88	**0.20**		5		5	6.42	**1.31**	12	46	0.005	**2.85**	3.63	5.5	1.67	241.70	241.45	CB-3 Rim=241.70
	WQ-1	Chambers			0.642			**0.70**	5		5	6.42	**4.47**	15	52	0.007	**5.75**	4.69	11.6	3.64	241.35	241.00	
WQ-2 to Underground Chambers																							
	WQ-2	Chambers		0.296		0.88	**0.26**		5		5	6.42	**1.67**	12	37	0.007	**3.18**	4.05	6.3	2.12	241.25	241.00	WQ-2 Rim =244.75
WQ-3 to Chambers																							
	WQ-3	Chambers		0.426		0.87	**0.37**		5		5	6.42	**2.38**	12	44	0.006	**2.92**	3.71	9.8	3.04	241.25	241.00	WQ-3 Rim=244.75
Chambers 8" FES Outlet																							
	Chambers	FES			1.364			**1.33**	5		5	6.42	**1.03**	8	21	0.040	**2.61**	7.48	3.2	2.95	242.83	242.00	

Notes:

1) Runoff Coefficient C-Values used; Impervious(Pavement) C=0.90 Grass/OpenSpace C=0.20, Residential Suburban C=.25~.40, Mannings "n" HDPE n=0.012, RCP n=0.013
2) Rainfall Intensity I (in/hr) values taken from Figure 10-4 Intensity-Duration-Frequency Curve for Boston, Massachusetts, Mass Highway Design Manual.
3) Five (5) minute minimum flow time used for minimum time of concentration (Tc) to CB inlet to system
4) Massachusetts Cascade Grate Inlet Capacity = 1.26 cfs @ 100% efficiency, Standard Grate = 0.95 cfs est.
5) Blue Highlight denotes calculated peak flow (cfs) to CB Inlet

Drainage Structure	Contributing Area Impervious	Grass/Lawn	Total s.f.	Ac.	Runoff Coefficient C
CB-1	11,711	170	11,881	0.273	0.89
CB-3	9,813	250	10,063	0.231	0.88
WQ-2	12,460	441	12,901	0.296	0.88
WQ-3	17,809	735	18,544	0.426	0.87
BLD	12,054		12,054	0.277	0.90



NO.	DATE	DESCRIPTION	BY	CKD
1.	3/4/2024	CLIENT CHANGE OF USE / BUILDING	RL	DTF

REVISIONS

PROFESSIONAL SEAL

PROJECT:
PROPOSED COMMERCIAL BUILDING
#39 ALDER STREET
MEDWAY, MA 02053

PREPARED FOR:
ETS EQUIPMENT RENTAL, INC.
11 AIRPORT ROAD
HOPEDALE, MA 01747

ENGINEERING SERVICES
ENVIRONMENTAL SERVICES
67 Hall Road
Sturbridge, MA 01566
Phone: 774-241-0901
fax: 774-241-0906

CMG EST. 2002

ISSUE DATE:	2/16/2024
DRAWN BY:	RL
CHECKED BY:	DTF
SCALE:	1" = 60'
PROJECT NO.	2020-149

SHEET NAME:
RATIONAL METHOD DRAINAGE MAP

SHEET NO.:
D - 3.0

Appendix G

Hydrostorm Manufacturer's Design Report

Technical Design Submission

ETS Equipment Rental
39 Alder Street
Medway, MA

Revised
3/4/2023

Hydroworks, LLC

Hydroworks Technical Submission for ETS Equipment Rental

Hydroworks is pleased to make a submission regarding the stormwater treatment measures for ETS Equipment Rental in Medway, MA. We propose the use of three HD 4 hydrodynamic separators and two HydroFilter stormwater filters for this project. Sizing calculations were based on an annual TSS removal objective of 80% for the NJDEP particle size distribution and treatment of the MADEP water quality flow rate.

Hydroworks HydroDome Operation

HydroDome is unique since it provides benefits for both water quality and water quantity or flow control. HydroDome comes complete and simply slides into the outlet pipe from a drainage structure and is secured to the wall with two anchor bolts. (Figure 1).

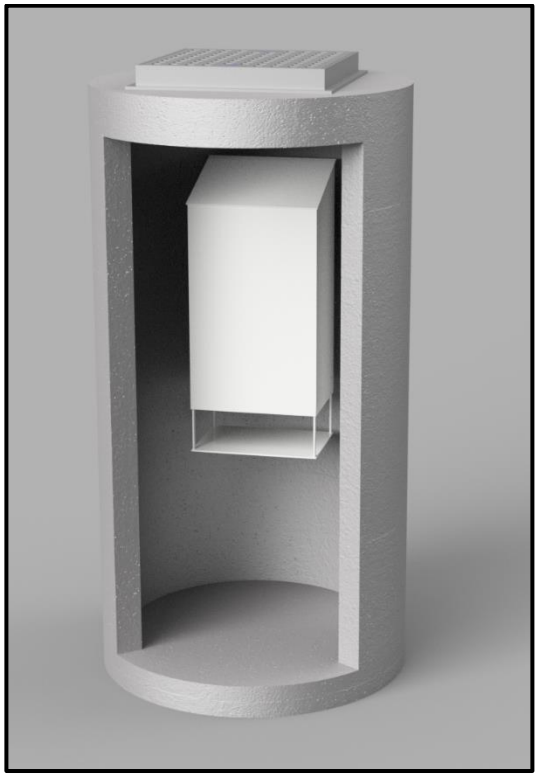


Figure 1. Hydroworks HydroDome

HydroDome consists of two main components:

1. A siphon with flow control
2. A flow weir (main flow path)

At the heart of HydroDome is a siphon that regulates the water level in the structure and the flow rate leaving the structure. (Figure 2)

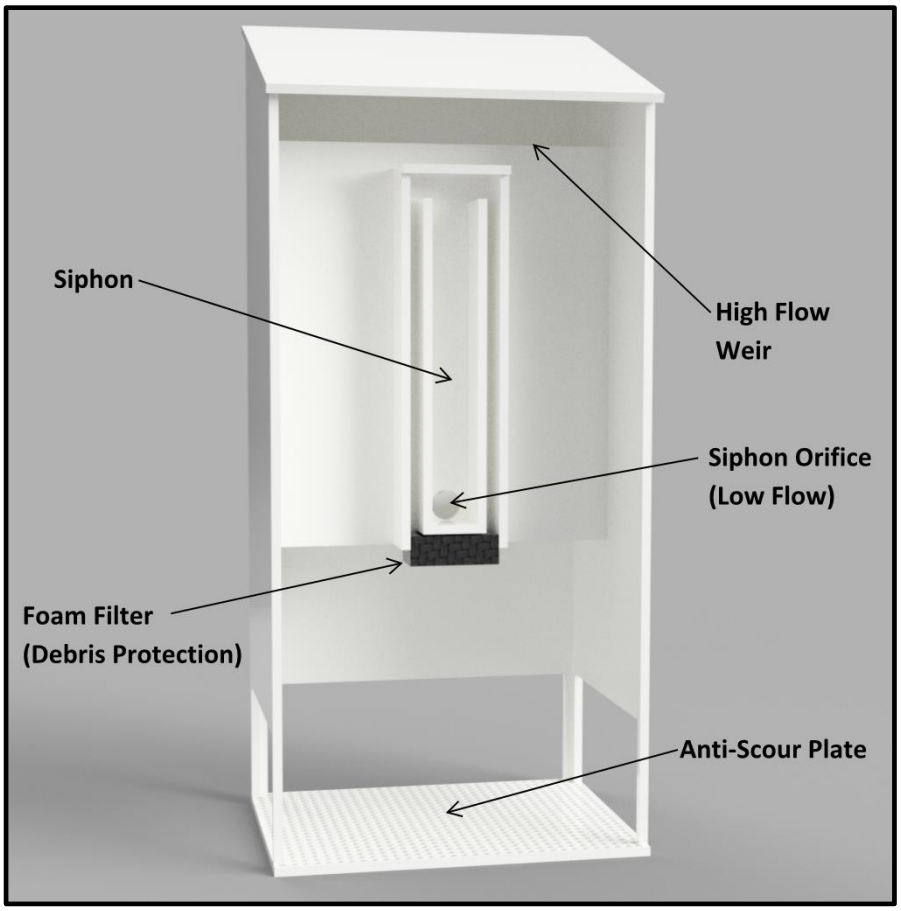


Figure 2 HydroDome Components

The siphon raises the water level to a pre-determined level without allowing water to exit the structure. The raised water level provides greater time for initial TSS removal, additional dilution to reduce effluent concentrations of any pollutants and provides a greater volume or buffer of water to prevent scour of previously settled solids.

Water flows into the device through horizontal openings at the bottom of the HydroDome. Water then must travel upwards through a siphon. A coarse foam screen is located at the entrance to the siphon to provide secondary protection for the siphon (primary protection provided by the body of the HydroDome itself). Once the water level reaches a pre-determined height the siphon begins to engage and water flows out of the structure downstream. The siphon flow is controlled by an orifice whose size can be changed to provide the desired flow control. The water level continues to rise since the siphon flow is regulated by a small orifice.

A high weir above the siphon provides the main flow path through the separator and prevents the system from surcharging. A scour protection plate minimizes scour by preventing upward velocities/flow from the structure floor during periods of peak flow.

HydroDome combines the function of separator, hood, and flow control with active storage to provide a multi-purpose stormwater management solution in one structure.

HydroDome can be used as an inlet structure or as a regular drainage structure without any modification.

The ETS Equipment Rental roof is proposed to be made from metal. MADEP has a requirement that runoff from metal roofs be treated by a filter. The roof drainage is split into two locations. Two separate HydroFilter units are proposed to treat each half of the roof.

HydroFilter is a NJDEP certified filter for stormwater treatment.

A standard HydroFilter (Figure 3) (no infiltration) will be designed at this site since infiltration is already proposed downstream of the filters.

Under normal or low flows, water enters the structure through a grate or inlet pipe . Incoming water builds up around the filters and creates head to drive water radially into the filter cartridges from the outside through to the center of the cartridge. There is a 6" (150mm) diameter open center that runs through the center of each cartridge. Water reaching the center flows down into the base plug and is conveyed out of the structure by a pipe that conveys the treated flow behind a weir wall or directly into the outlet pipe. The height of the weir wall provides the necessary head to push the inlet water through the filter and is required in designs without a difference in head between the inlet and outlet elevations.

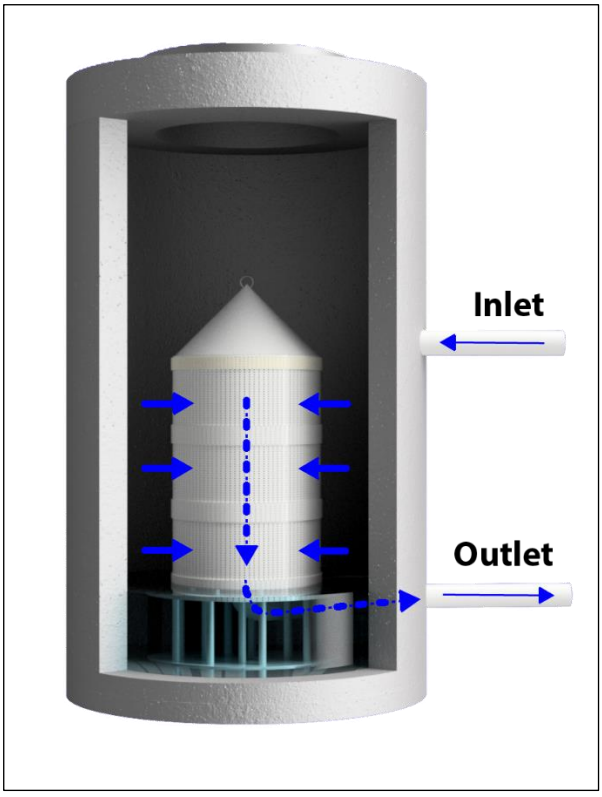


Figure 3. Hydroworks HydroFilter Operation

Construction Materials

The internal components of the HydroDome and HydroFilter are made from HDPE. The shell of the structure is pre-cast concrete. Pre-cast concrete is readily accepted by all municipalities since it has the following advantages:

- long service life

- ease of installation (less dependent on backfill (contractor proficiency) for structural integrity)
- concrete structures are designed for both anti-buoyancy and traffic loading without any field requirements (such as structural loading slabs in traffic areas and anti-buoyancy slabs to prevent groundwater uplift).
- low maintenance requirements

Hydroworks HD Separator Dimensions and Capacities

The HD separator is manufactured in a variety of sizes from 4 ft inside diameter to 12 ft inside diameter as shown in Table 1.

Table 1. Hydroworks HD Separator Dimensions*

Model	Structure Inside Diam. (ft)	Structure Depth (ft)*	Sediment/ Sinking Trash Volume (ft^3)	Oil/Floating Trash Volume (gal)	Permanent Pool (Wet) Volume (gal)
HD 3	3	4	11	31	210
HD 4	4	4	25	70	420
HD 5	5	5.5	47	134	805
HD 6	6	6.5	80	230	1375
HD 7	7	7.5	125	360	2155
HD 8	8	8.5	188	560	3195
HD 10	10	10.5	367	1125	6165
HD 12	12	12.5	631	1975	10575

*Dimensions vary with project requirements

The volumes provided in Table 1 for oil and sediment are to full capacity and not indicative of recommended depths/volumes for maintenance.

Site Drainage

Drainage areas were delineated from the Grading and Drainage Plan (C-2.0). These areas are shown in Figure 4. Water quality flows were derived using the standard MADEP calculations using 1" of runoff over the impervious area. The water quality flows are provided in Table 2.

Table 2. ETS Equipment Rental Water Quality Separator Parameters

Location	Area (ac)	Impervious (%)	WQF (cfs)*	Recommended Unit
WQ-1	0.90	90	0.98	HD 4
WQ-2	0.31	100	0.37	HD 4
WQ-3	0.42	100	0.51	HD 4

*Based on 1" of runoff and 6 min time of concentration

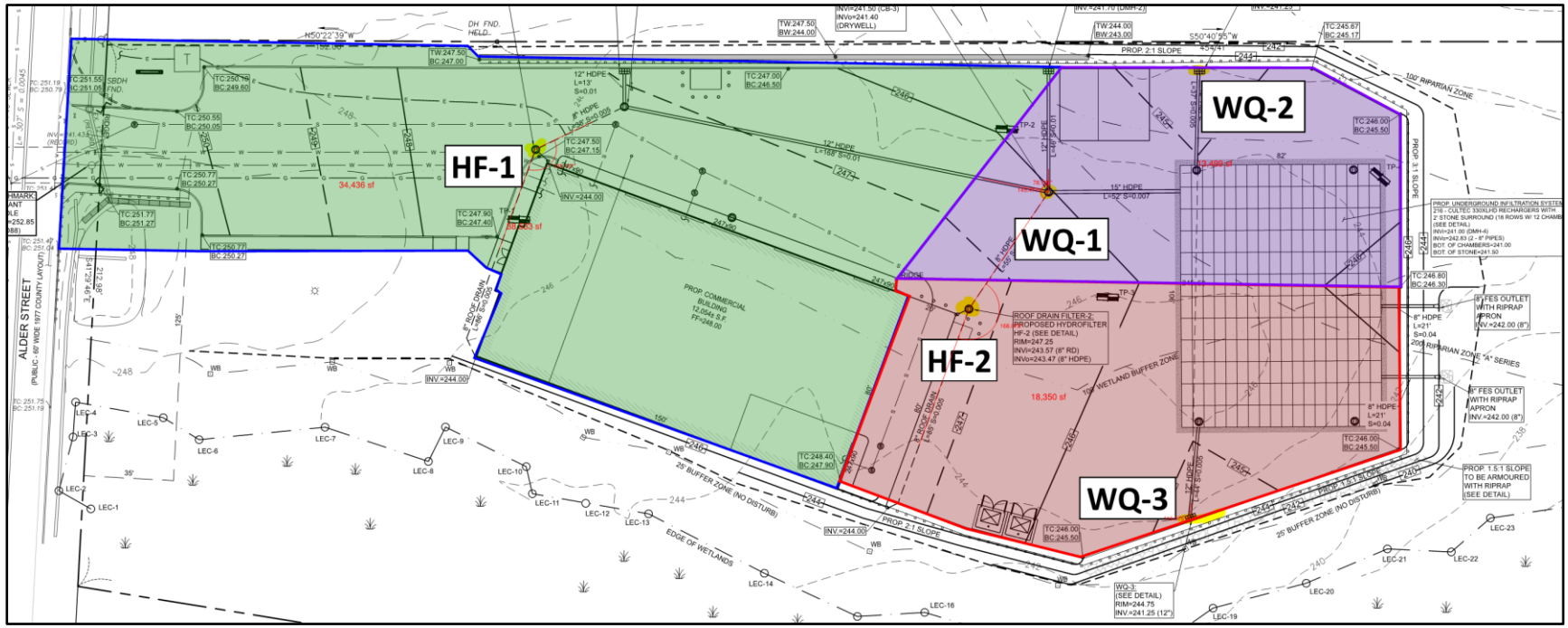


Figure 4. ETS Equipment Rental Drainage Areas

The HydroDome HD 4 water quality treatment rate based on NJDEP ratings is 1.51 cfs. Therefore, the HD 4 is the appropriate size of separator for this project for water quality treatment.

The HydroFilters were sized based on using the Hydroworks SWMM program that simulates runoff on a continuous basis for historical rainfall records. The design criteria is to provide 80% TSS removal based on the NJDEP particle size distribution. A HydroFilter HF2 is proposed to treat each half of the metal roof runoff. The HydroFilter is NJDEP certified to provide 85% TSS removal based on 12.5 gpm per cartridge and the NJDEP particle size distribution.

The criteria of 80% removal of the NJDEP particle size distribution and treatment of 90% of the annual runoff without bypass was used for this design. An HF 2 is required for each half of the roof to meet the treatment and flow capture criteria.

TSS Removal Calculations for the Specified System

Hydroworks sizes separators based on continuous analysis of rainfall, runoff, and TSS settling in the HydroDome based on laboratory testing.

These calculations require a user input particle size distribution. We have used the NJDEP particle size distribution for this project.

Table 3. ETS Equipment Rental TSS Particle Size Distribution	
Particle Size (um)	% by Mass
1	5
4	5
7	10
18	15
45	10
70	5
90	10
125	15
200	15
400	5
850	5

TSS removal calculations in the sizing program are based on the HydroDome being a completely mixed reactor vessel. The removal calculations solve a first order differential equation for the concentration of solids in the tank at any time. The first order differential equation is for continuity of mass.

$C'V = QC_i - QC_t - r_cV$

C' = the change in concentration of solids in the tank with time
Q = flow rate through the tank
C_i = solids concentration in the influent to the tank
C_t = solids concentration in the tank
V = tank volume
r_c = reduction in solids in the tank (TSS Removal)

Continuous simulation requires historical rainfall data. Forty-five years of rainfall data (1957-2001) from Worcester, MA, were used to analyze the ETS Equipment Rental project.

Laboratory testing (Alden, 2020) results for TSS removal for the HydroDome using the NJDEP TSS distribution is provided in Figure 5. Figure 6 shows the NJDEP TSS particle size distribution tested with the HD 3.

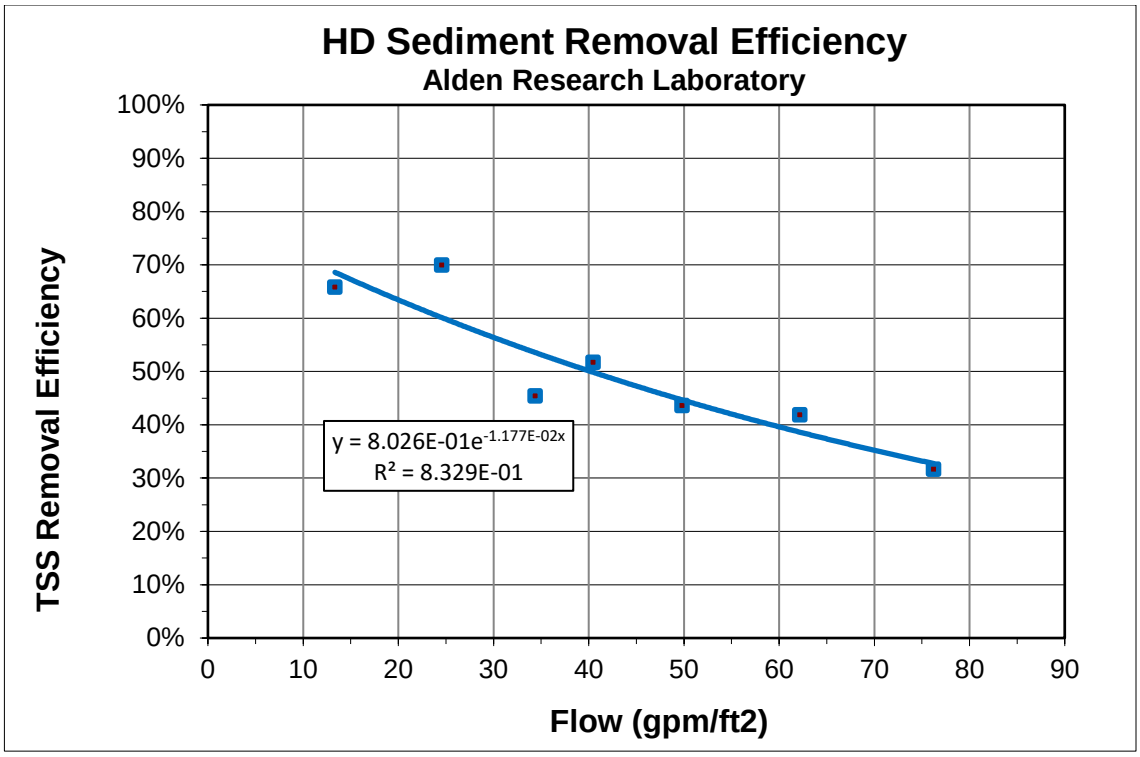


Figure 5. HydroDome TSS Removal Results (Alden, 2020)

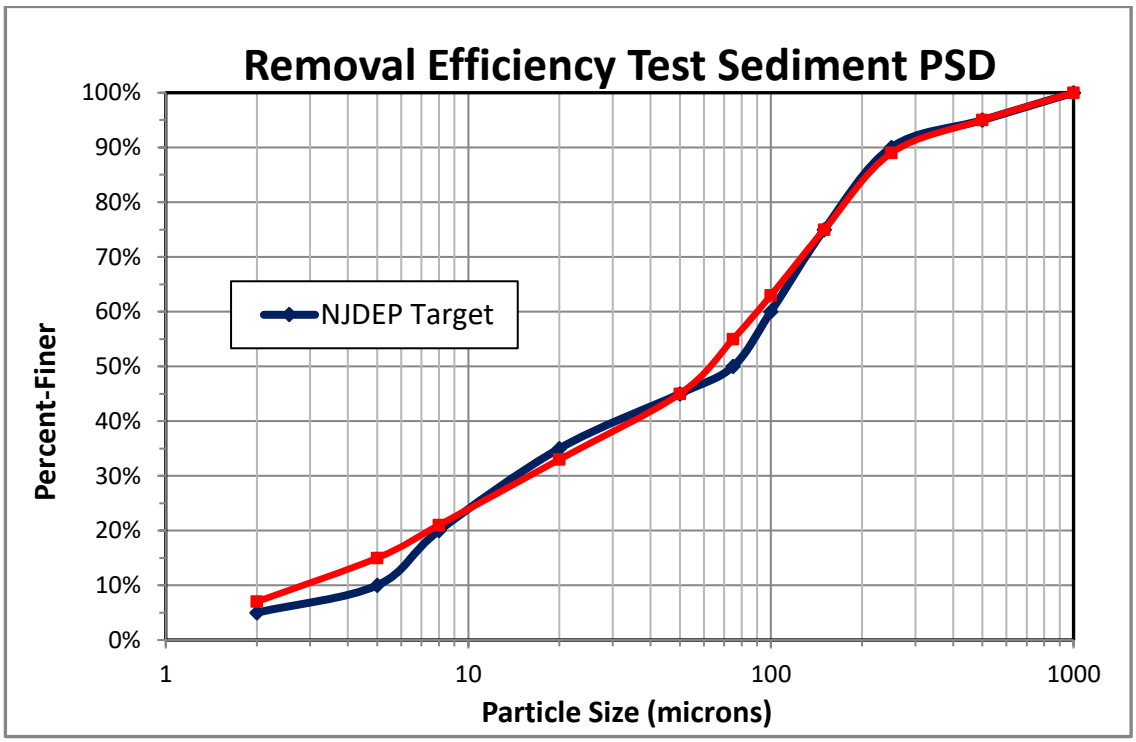


Figure 6. NJDEP TSS Particle Size Distribution (Alden, 2020)

Hydroworks uses the Peclet Number to calculate TSS removal based on the independent laboratory testing. The Peclet number has been used as a dimensionless scaling number for sediment deposition in lakes (Dhamotharan, et. Al. 1981). Others have suggested its use for scaling of TSS removal results for hydrodynamic separators (Dhanak, 2008, Gulliver, Guo and Wu, 2008, ASCE, EWRI, NJDEP).

The Peclet number is the ratio of convection (convective settling) to diffusion (turbulence keeping particles in suspension). The Peclet number (Equation 1) varies with the size of separator, particle size of TSS, and flow rate.

$$Pe = Vs\ h\ d\ /Q \qquad \text{Equation 1}$$

Where Pe = Peclet number
Vs = settling velocity
h = characteristic dimension
d = characteristic dimension
Q = flow rate

The Peclet number equates to surface area scaling if d and h are assumed to the length and width or diameter of a separator. A particle will be removed in the separator if the Peclet number is equal to, or greater than, the Peclet number calculated for removal of that particle based on the independent laboratory results. Based on the NJDEP PSD in Figure 6, the TSS removal in Figure 5, and the dimensions of the tested HD 3, critical Peclet Numbers can be calculated for each particle size in Figure 6 (critical Peclet number is the Peclet Number above which the particle is removed). A critical Peclet Number curve was then developed and input to the model (Figure 7).

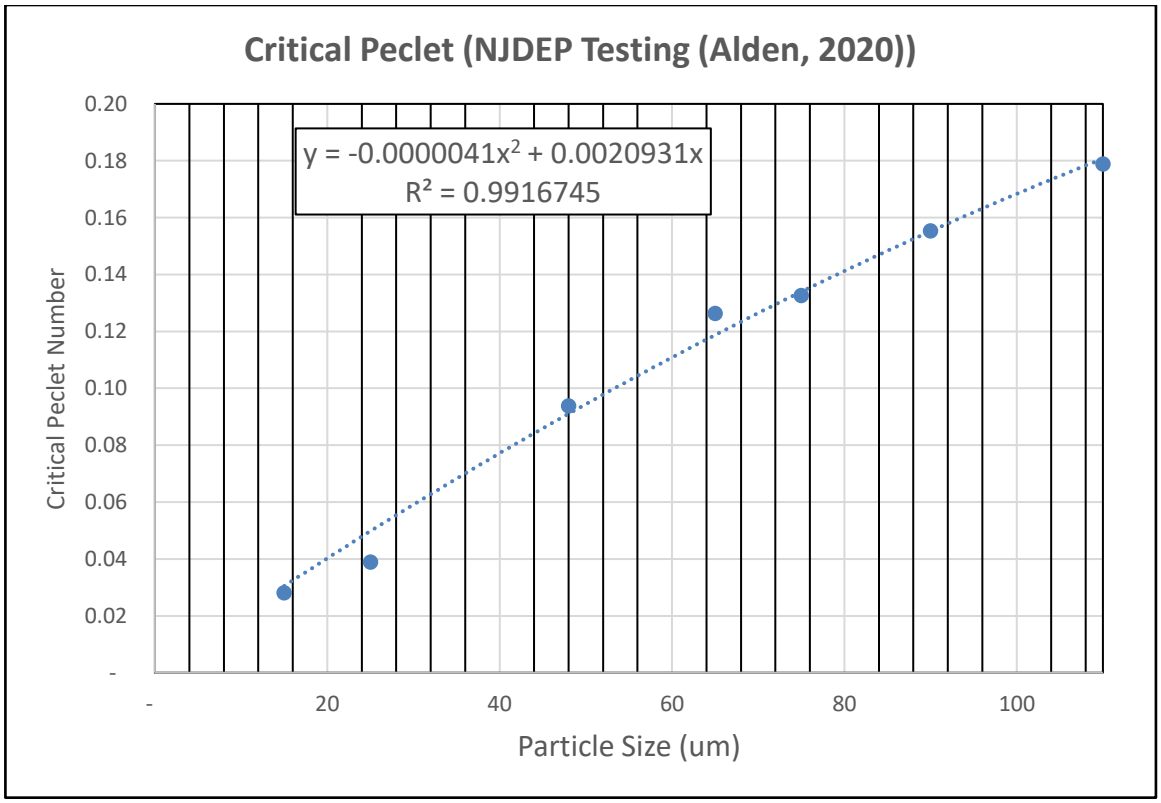


Figure 7. Critical Peclet Number Curve

At each timestep the Peclet Number is calculated for every flow and every HydroDome separator for each particle size in the design particle size distribution. The calculated Peclet Number is then compared to the Critical Peclet Number to determine if the particle is removed at that timestep or not (removed if the calculated Peclet Number is greater than the Critical Peclet Number and not removed if less than the Critical Peclet Number). These calculations are done for the entire rainfall record and all particle sizes in the distribution to determine an overall TSS removal percentage.

Hydroworks added a Peclet routine to the USEPA SWMM model to determine TSS removal based on the Peclet number calibrated to the independent laboratory testing completed by Alden Research Laboratory (regression equation in Figure 6).

The use of the Peclet Number allows Hydroworks to size the HydroDome based on any particle size and design storm or local hydrology.

The NJDEP TSS removal performance for HydroFilter is given in Figure 8 at 12.5 gpm per cartridge. The HydroFilter provides 85% TSS removal at this flow rate. The HydroFilters were assessed for this project using long term historical rainfall by summing the removal of 85% TSS at or below 12.5 gpm per cartridge and 0% for the flow volume above 12.5 gpm/cartridge.

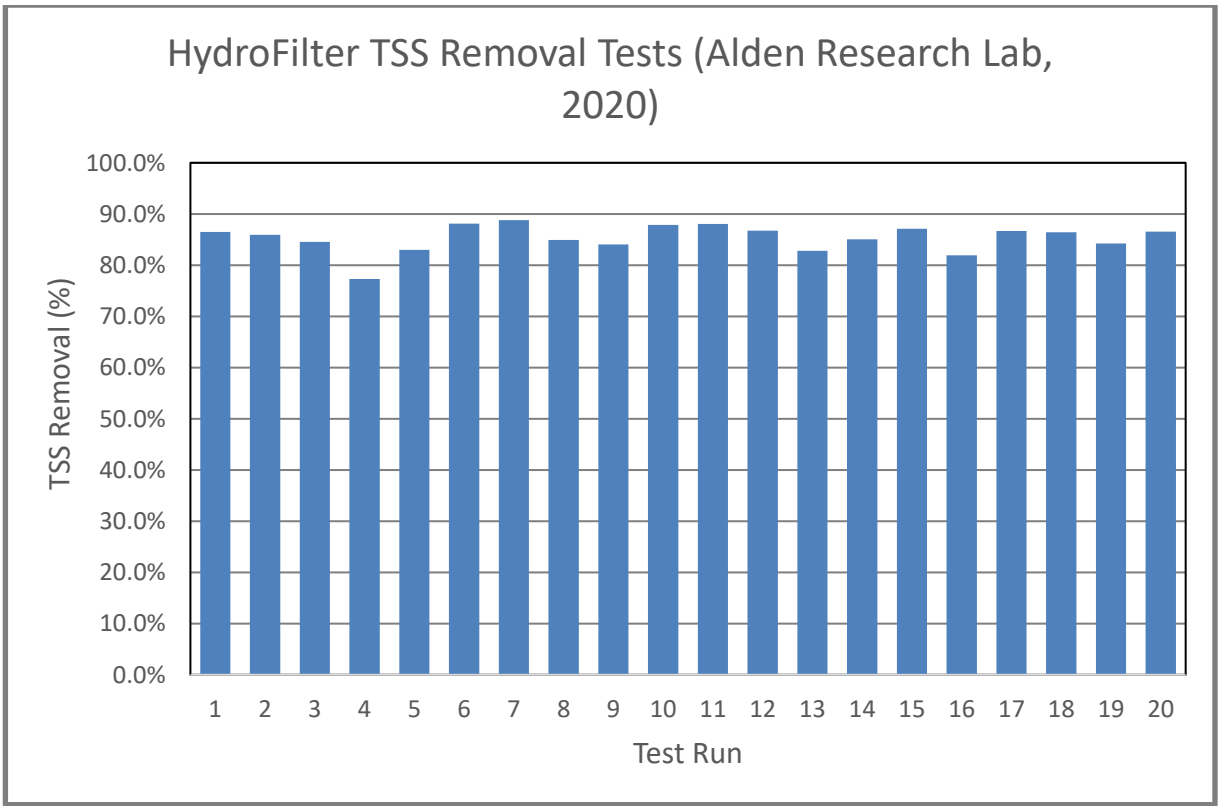


Figure 8. HydroFilter NJDEP Test Results

Sizing Recommendations

TSS Removal

The annual TSS removal results are given in Figures 9 to 12. The sizing indicates the HD 4 separators and HF 2 filters are appropriately sized to provide 80% TSS removal.

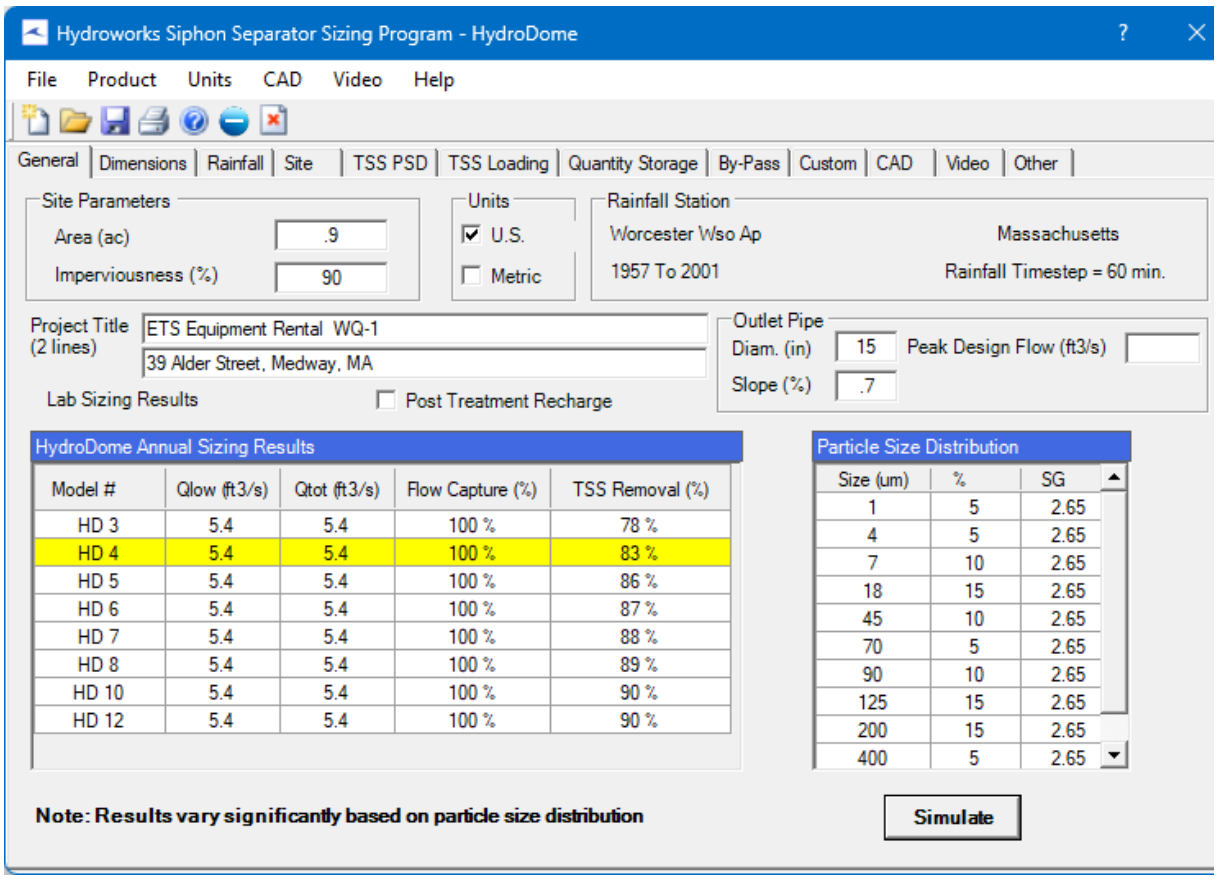


Figure 9. ETS Equipment Rental Separator Sizing Results – WQ-1

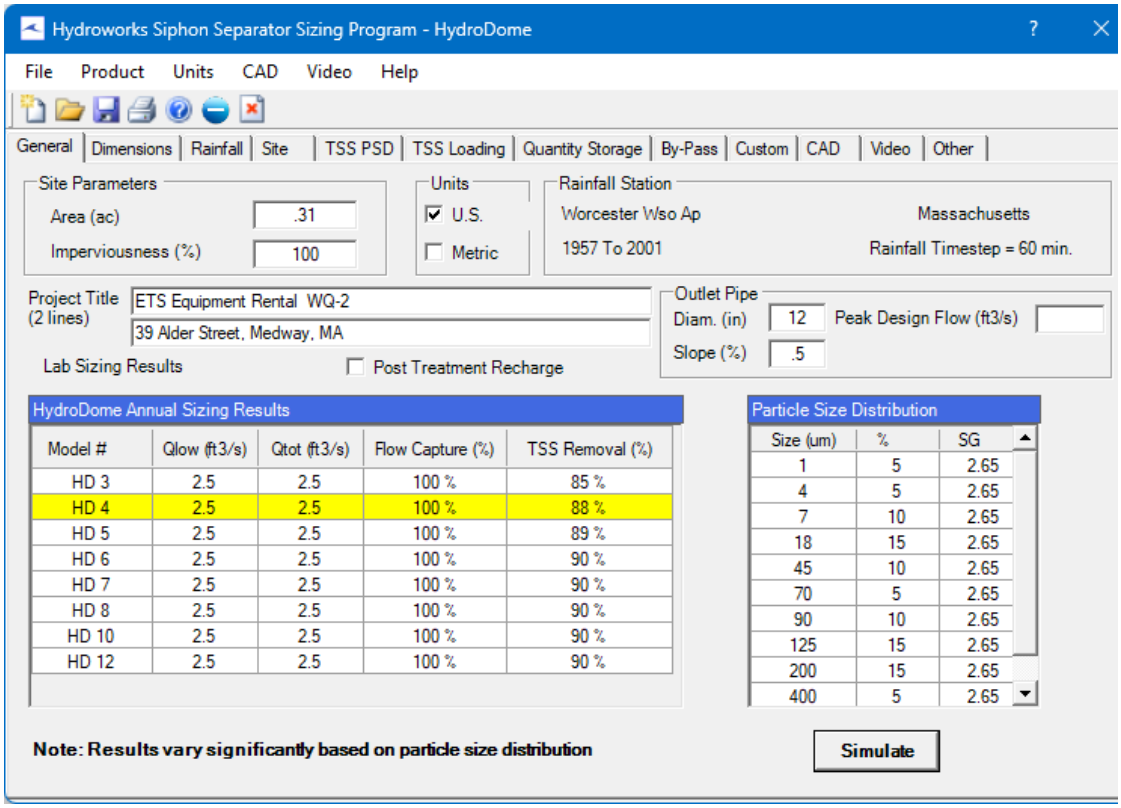


Figure 10. ETS Equipment Rental Separator Sizing Results – WQ-2

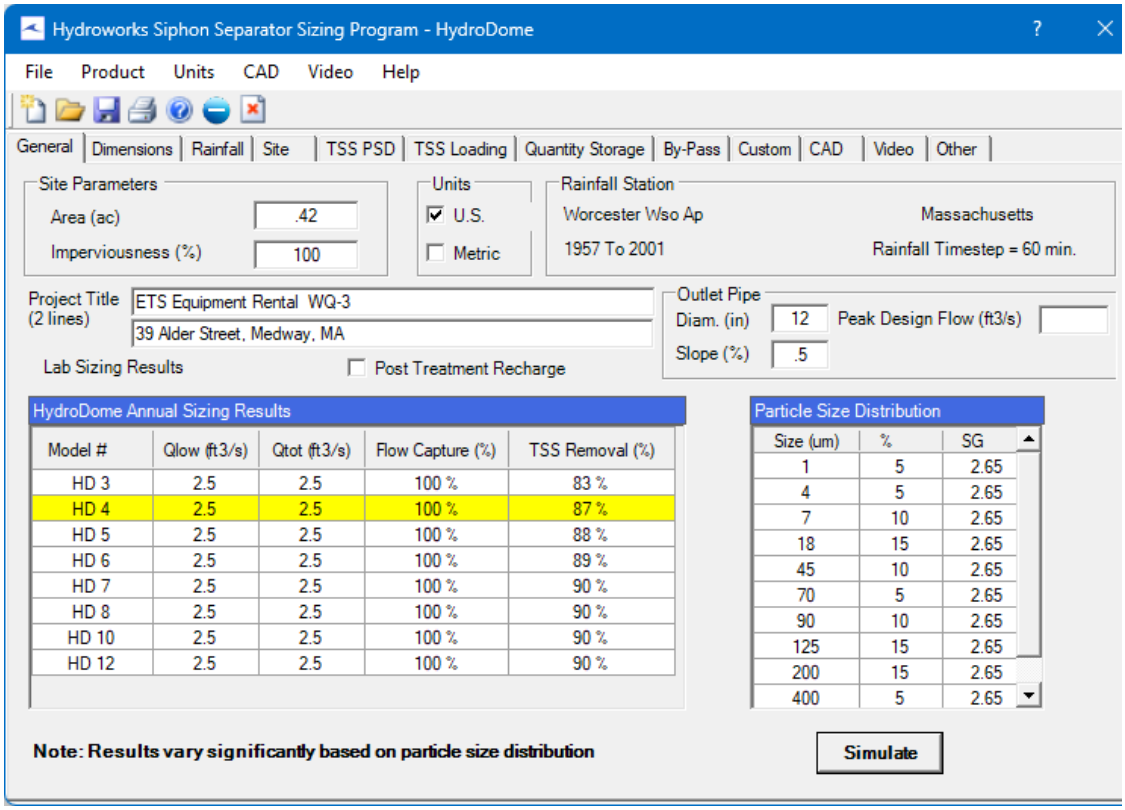


Figure 11. ETS Equipment Rental Separator Sizing Results – WQ-3

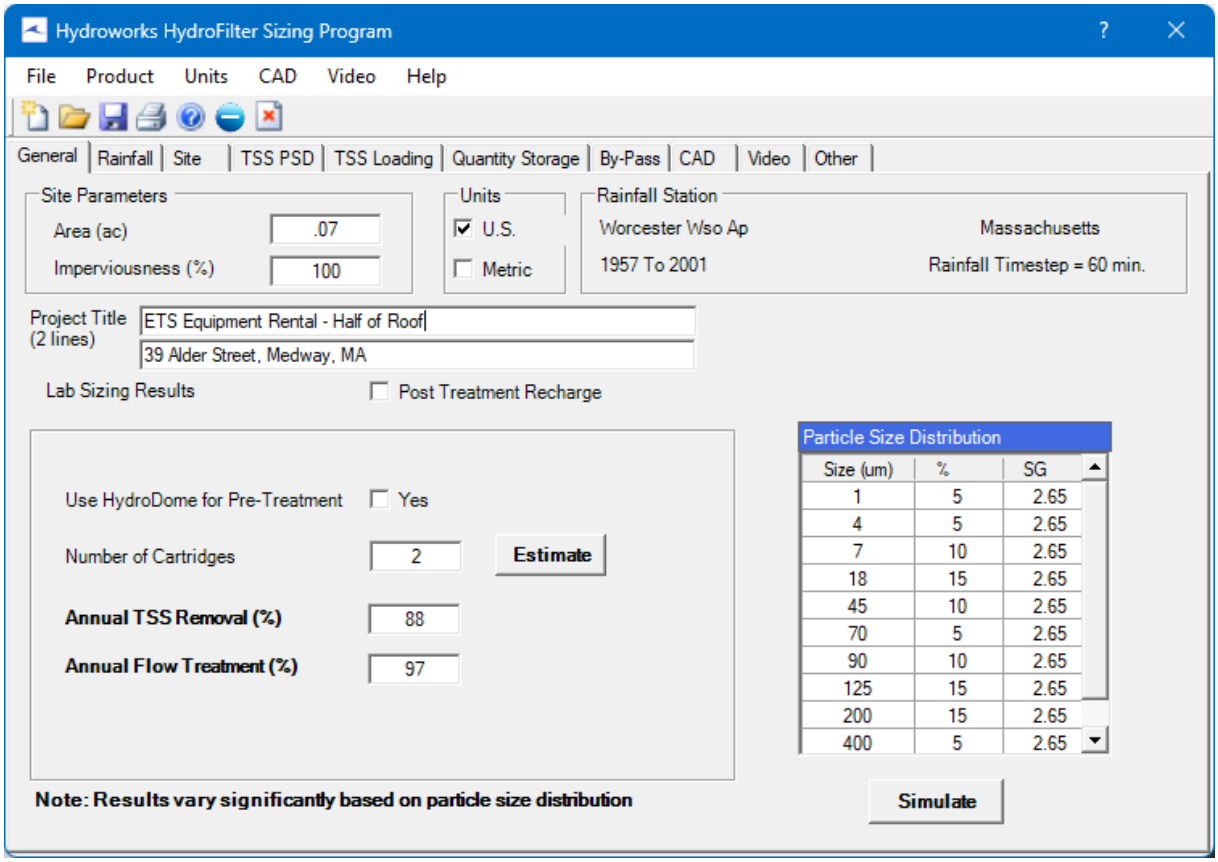


Figure 12. ETS Equipment Rental Separator Sizing Results – HF-1 & HF-2

Local Production

Hydroworks units are made locally in MA, CT, and NH. Therefore, the use of HydroDome and HydroFilter supports the local New England economy.

Summary

We propose the use of three HydroDome HD 4 separators for the parking lot and two HydroFilter HF 2 filters for the roof on the ETS Equipment Rental project in Medway, MA. The proposed separators and filters will provide 80% annual TSS removal for the NJDEP TSS particle size distribution and treat the site water quality flow rate.

APPENDIX 1

HydroDome Approvals & HydroFilter Approvals

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
PHILIP D. MURPHY
Governor
SHEILA Y. OLIVER
Lt. Governor
DIVISION OF WATERSHED PROTECTION AND RESTORATION
BUREAU OF NJPDES STORMWATER PERMITTING & WATER QUALITY MANAGEMENT
P.O. Box 420 Mail Code 401-02B
Trenton, New Jersey 08625-0420
609-633-7021 / Fax: 609-777-0432
www.njstormwater.org
SHAWN M. LATOURETTE
Commissioner

June 30, 2021

Graham Bryant
President
Hydroworks, LLC
257 Cox Street
Roselle, NJ 07203

Re: MTD Lab Certification
HydroDome (HD) Stormwater Separator by Hydroworks, LLC
On-line Installation

TSS Removal Rate 50%

Dear Mr. Bryant:

The Stormwater Management rules under N.J.A.C. 7:8-5.2(f) and 5.2(j) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Hydroworks, LLC has requested an MTD Laboratory Certification for the HydroDome Stormwater Separator (HydroDome).

The project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report dated May 2021 with the Verification Appendix for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the HydroDome by Hydroworks, LLC at a TSS removal rate of 50% when designed, operated and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5.

2. The HydroDome shall be installed using the same configuration reviewed by NJCAT and shall be sized in accordance with the criteria specified in in item 6 below.

3. This HydroDome cannot be used in series with another MTD or a media filter (such as a sand filter), to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 11.3 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found on-line at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the HydroDome, which is attached to this document. However, it is recommended to review the maintenance manual at www.hydroworks.com\hdmaintenance.pdf for any changes to the maintenance requirements.

6. Sizing Requirements:

   The example below demonstrates the sizing procedure for the HydroDome:

   Example: A 0.25-acre impervious site is to be treated to 50% TSS removal using a HydroDome. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

   Maximum Treatment Flow Rate (MTFR) Evaluation:

   The site runoff (Q) was based on the following:
   time of concentration = 10 minutes
   i=3.2 in/hr (page 21, Fig. 5-10 of Chapter 5 of the NJ Stormwater BMP Manual)
   c=0.99 (curve number for impervious)
   Q=ciA=0.99x3.2x0.25=0.79 cfs

   Given the site runoff is 0.79 cfs and based on Table 1 below, the HydroDome Model HD 3 with a MTFR of 0.85 cfs would be the smallest model approved that could be used for this site that could remove 50% of the TSS from the impervious area without exceeding the MTFR.

   The sizing table corresponding to the available system models is noted below. Additional specifications regarding each model can be found in the Verification Appendix under Table A-1 and Table A-2.

Table 1 HydroDome Models

HydroDome Model	Manhole Diameter (ft)	Maximum Treatment Flowrate, MTFR (cfs)
HD 3	3	0.85
HD 4	4	1.51
HD 5	5	2.36
HD 6	6	3.40
HD 7	7	4.63
HD 8	8	6.03
HD 10	10	9.44
HD 12	12	13.60

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all the items identified in the Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Lisa Schaefer of my office at lisa.schaefer@dep.nj.gov.

Sincerely,

Gabriel Mahon, Chief
Bureau of NJPDES Stormwater Permitting & Water Quality Management
Division of Watershed Protection and Restoration
New Jersey Department of Environmental Protection

Attachment: Maintenance Plan

cc: Richard Magee, NJCAT

State of New Jersey

PHILIP D. MURPHY
Governor

SHEILA Y. OLIVER
Lt. Governor

Division of Water Quality
Bureau of Nonpoint Pollution Control
401 East State Street
P.O. Box 420 Mail Code 401-02B
Trenton, New Jersey 08625-0420
Phone: 609-633-7021 / Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

CATHERINE R. McCABE
Commissioner

December 17, 2020

Graham Bryant, M.Sc., P.E.
President
Hydroworks, LLC
257 Cox Street
Roselle, NJ 07203

Re: MTD Lab Certification
Hydroworks HydroFilter
On-line Installation Approved

TSS Removal Rate 80%

Dear Mr. Bryant:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Hydroworks, LLC has requested a Laboratory Certification for the HydroFilter filtration device.

The project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix (dated December 2020) for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the HydroFilter stormwater treatment unit by Hydroworks at a TSS removal rate of 80% when designed, operated, and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5. The MTFR is calculated based on a verified loading rate of 2.0 gpm/ft^2 of effective filtration treatment area.

2. The HydroFilter stormwater treatment unit shall be installed using the same configuration reviewed by NJCAT, and sized in accordance with the criteria specified in item 7 below.

3. This device cannot be used in series with another MTD or a media filter (such as a sand filter) to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual, which can be found online at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the HydroFilter. A copy of the maintenance plan is attached to this certification. However, it is recommended to review the maintenance website at https://hydroworks.com/hfmaintenance.pdf for any changes to the maintenance requirements.

6. For an MTD to be considered "green infrastructure" (GI) in accordance with the March 2, 2020 amendments to the Stormwater Management rules at N.J.A.C. 7:8, the MTD must meet the GI definition noted at amended N.J.A.C. 7:8-1.2. Specifically, the MTD shall (1) treat by infiltration into subsoil; and/or (2) treat stormwater runoff through filtration by vegetation or soil; or (3) store stormwater for reuse.

   While the HydroFilter can be designed upstream of an infiltration facility, such as a subsurface infiltration basin, the HydroFilter itself does not provide infiltration of the water quality design storm and does not incorporate any vegetation, soil, or storage of stormwater for reuse. As such, it does not meet the definition of green infrastructure at N.J.A.C. 7:8-1.2. However, like any NJDEP certified filtration MTD, if it is utilized as the required 80% TSS removal pre-treatment for a subsurface infiltration basin designed in accordance with Chapter 9.5 of the New Jersey Stormwater BMP Manual, the overall system will meet the definition of GI, since the subsurface infiltration basin does meet the GI definition.

7. Sizing Requirement:

   The example below demonstrates the sizing procedure for the HydroFilter:

   Example: A 0.25-acre impervious site is to be treated to 80% TSS removal using the HydroFilter. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

The selection of the appropriate model of HydroFilter is based upon both the maximum inflow drainage area and the MTFR. It is necessary to calculate the required model using both methods and to use the largest model determined by the two methods.

Inflow Drainage Area Evaluation:

The drainage area to the HydroFilter in this example is 0.25 acres. Included in Table 1 below, several HydroFilter models are designed with a maximum allowable drainage area greater than 0.25 acres. Specifically, the HydroFilter model HF B8-12-1 with a maximum drainage area allowable of 0.27 acres would be the smallest model able to treat runoff without exceeding the maximum allowable drainage area.

Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was based on the following:

time of concentration = 10 minutes
i = 3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
c = 0.99 (runoff coefficient for impervious)
$Q = ciA = 0.99 \times 3.2 \times 0.25 = 0.79$ cfs

Given the site runoff is 0.79 cfs and based on the MTFR's listed in Table 1 below, the HydroFilter HF B20-30-1 with an MTFR of 0.84 cfs would be the smallest model that could be used to treat the impervious area without exceeding the MTFR. If using more than one unit for treating runoff, the units should be configured such that the flowrate to each unit does not exceed the design MTFR for each unit and ensuring the entire 0.25 acre area is treated.

The MTFR evaluation results will be used since that method results in the highest minimum configuration determined by the two methods.

If you have any questions regarding the above information, please contact Brian Salvo of my office at (609) 633-7021.

Sincerely,

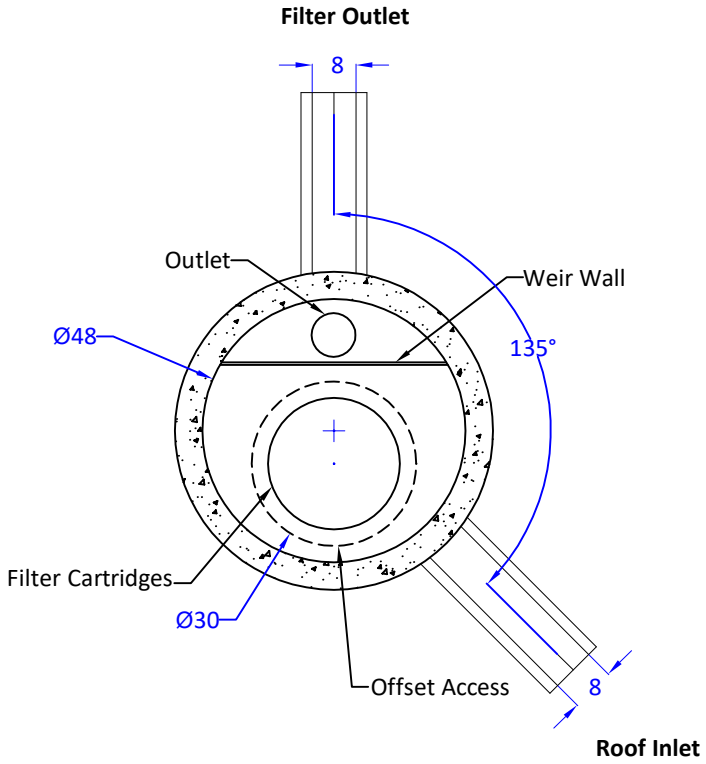
Gabriel Mahon, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP – Water & Land Management
Nancy Kempel, NJDEP– BNPC
Brian Salvo, NJDEP – BNPC
Keith Stampfel, NJDEP – DLRP
Dennis Contois, NJDEP – DLRP

APPENDIX 2

CAD Drawings



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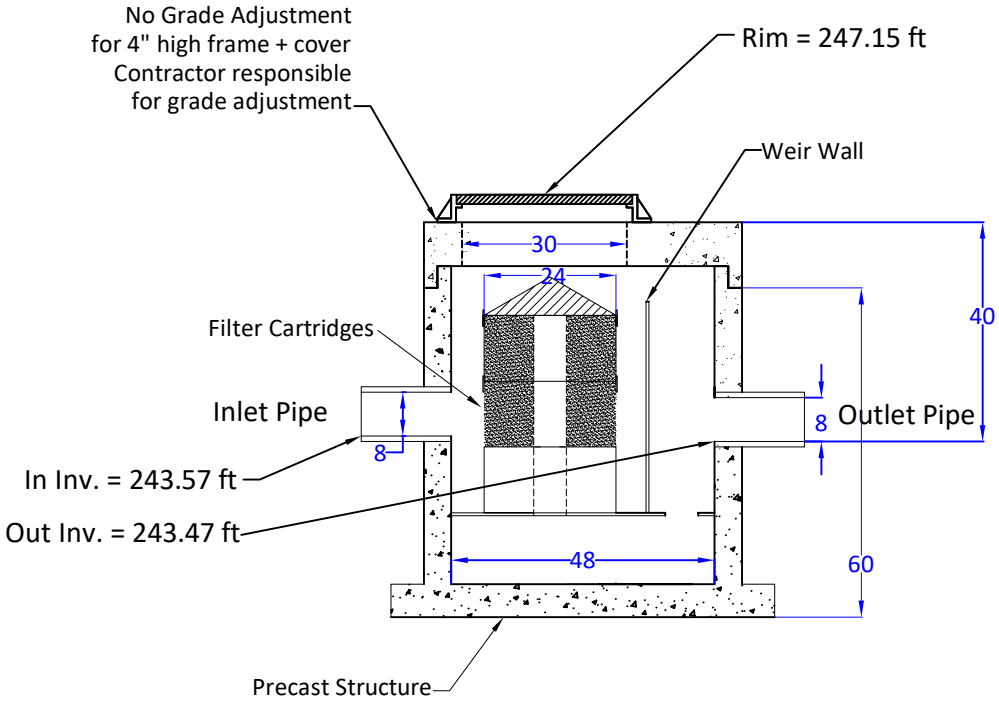


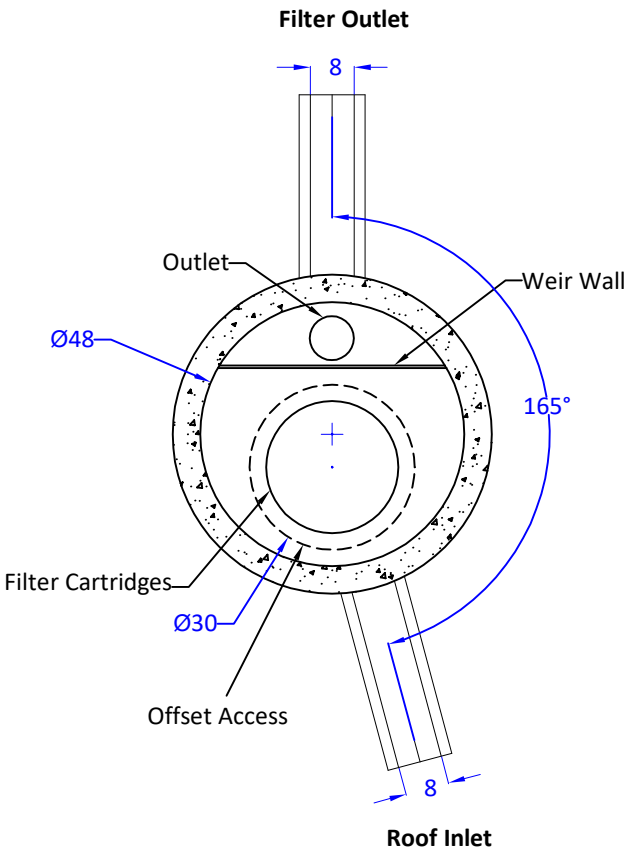
Profile

HydroFilter HF2 (48"Ø)

PROJECT:	39 Alder HF-1
LOCATION:	Medway, MA
REVISION DATE:	3/3/2023

HydroFilter by
Hydroworks, LLC
US Patent 6,913,155
www.hydroworks.com
888-290-7900

Hydroworks



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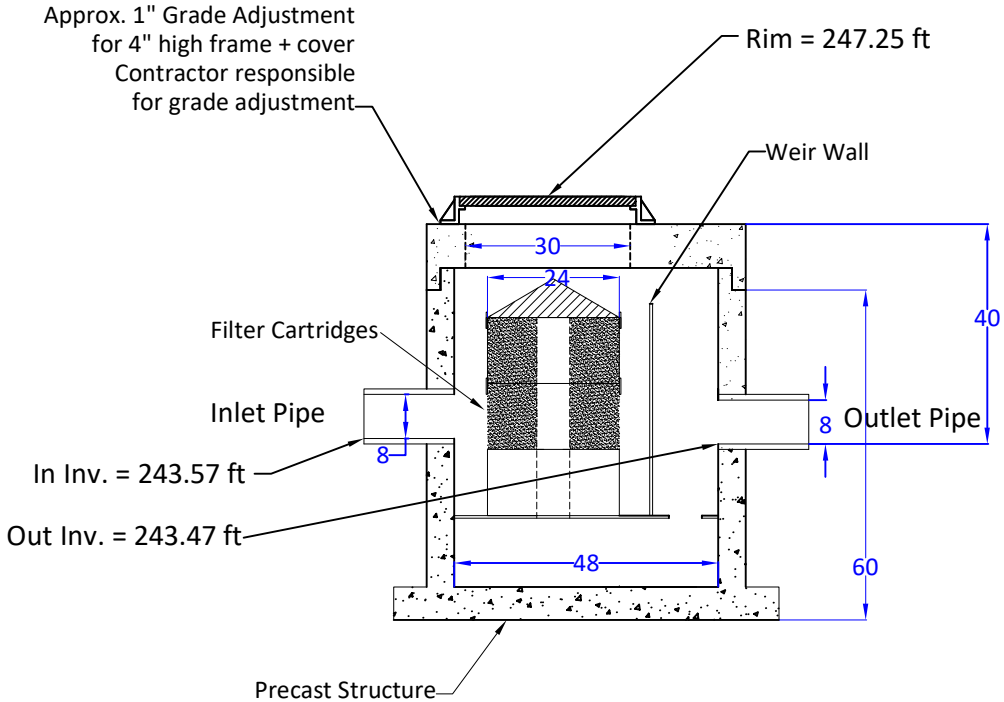

Profile

HydroFilter HF2 (48"Ø)

PROJECT:	39 Alder HF-2
LOCATION:	Medway, MA
REVISION DATE:	3/3/2023

HydroFilter by
Hydroworks, LLC
US Patent 6,913,155
www.hydroworks.com
888-290-7900

Hydroworks

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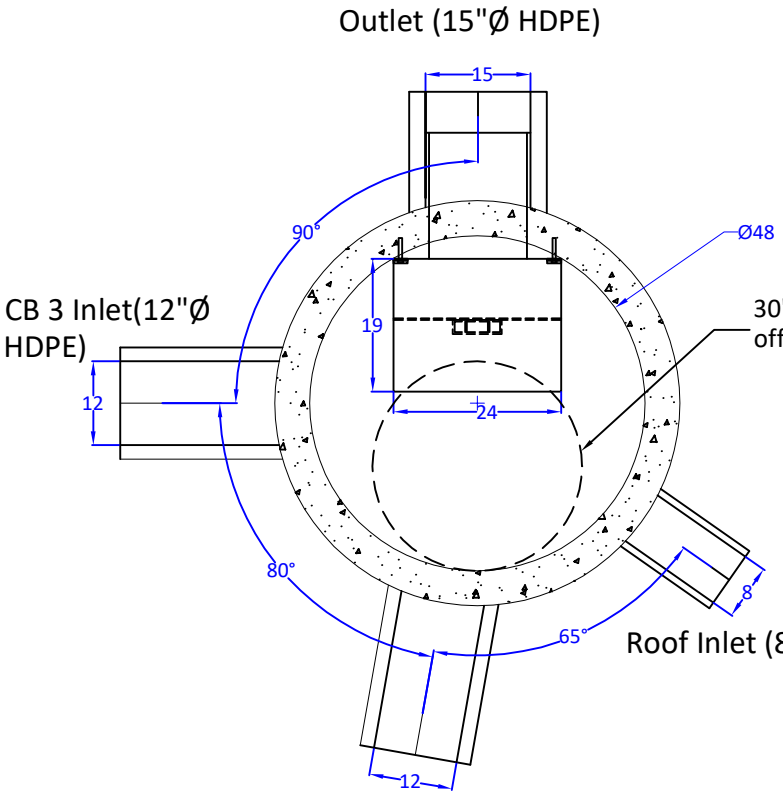

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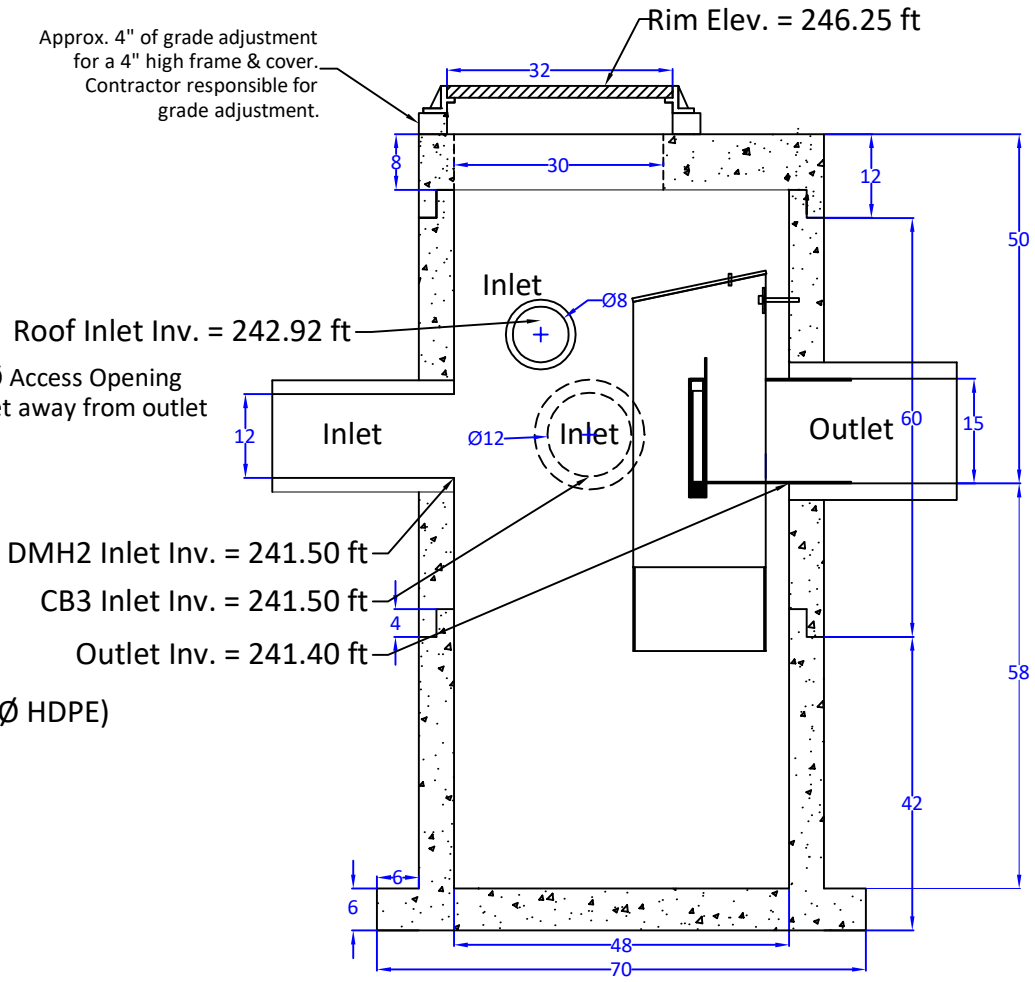

Profile

Any alternate equal must have independent testing to both the 2013 NJDEP separator protocol and the 2013 ETV Canada separator protocol

HydroDome by
Hydroworks, LLC
U.S. Patent #10,801,196
www.hydroworks.com
888-290-7900

Hydroworks HD4 (48"Ø)

PROJECT: 39 Alder WQ-1

LOCATION: Medway, MA

REVISION DATE: 3/3/2023

Hydroworks

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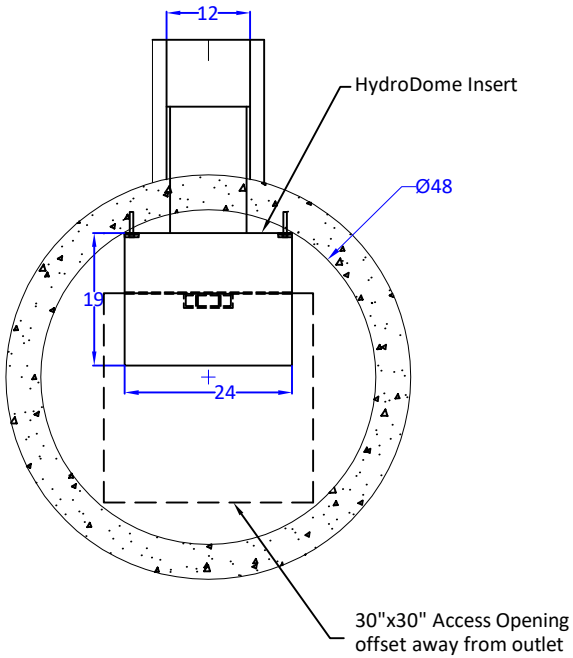

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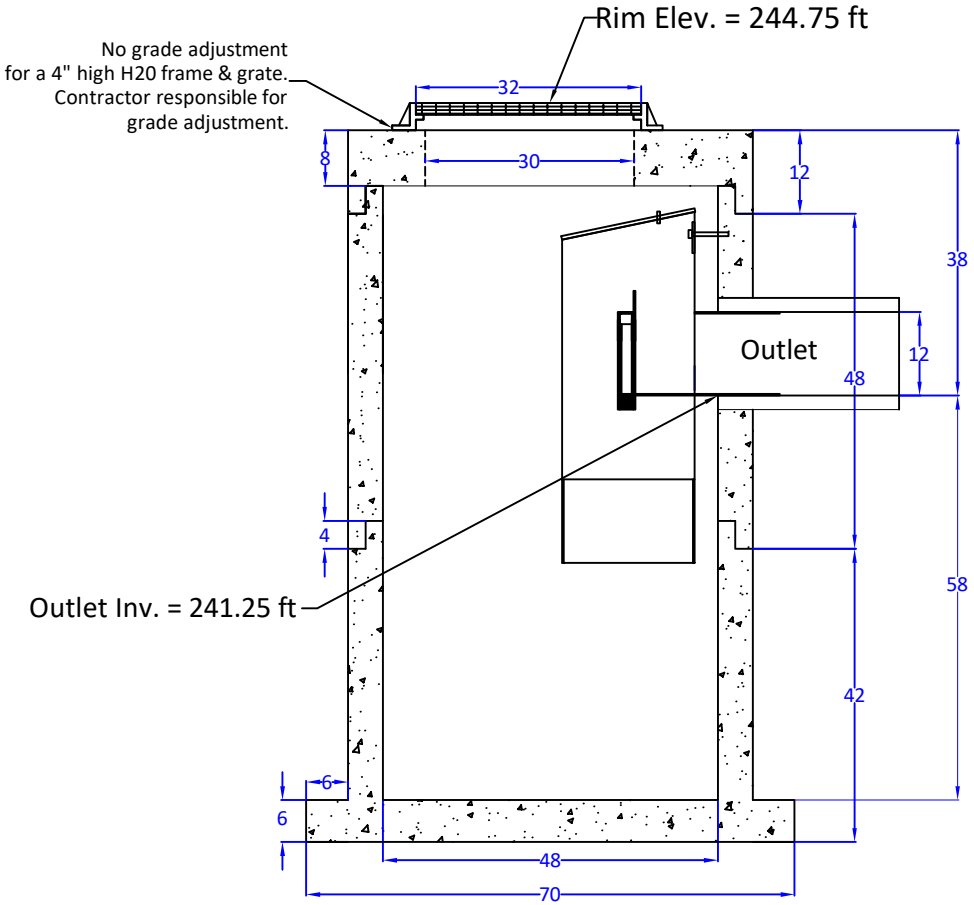

Profile

Any alternate equal must have independent testing to both the 2013 NJDEP separator protocol and the 2013 ETV Canada separator protocol

HydroDome by
Hydroworks, LLC
U.S. Patent #10,801,196
www.hydroworks.com
888-290-7900

Hydroworks HD4i (48"Ø)

PROJECT: 39 Alder (WQ-2)

LOCATION: Medway, MA

REVISION DATE: 2/2/2023

Hydroworks

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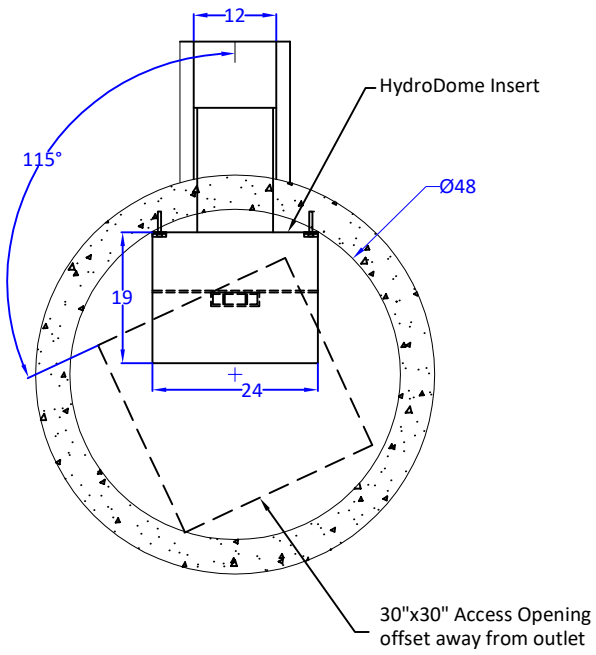

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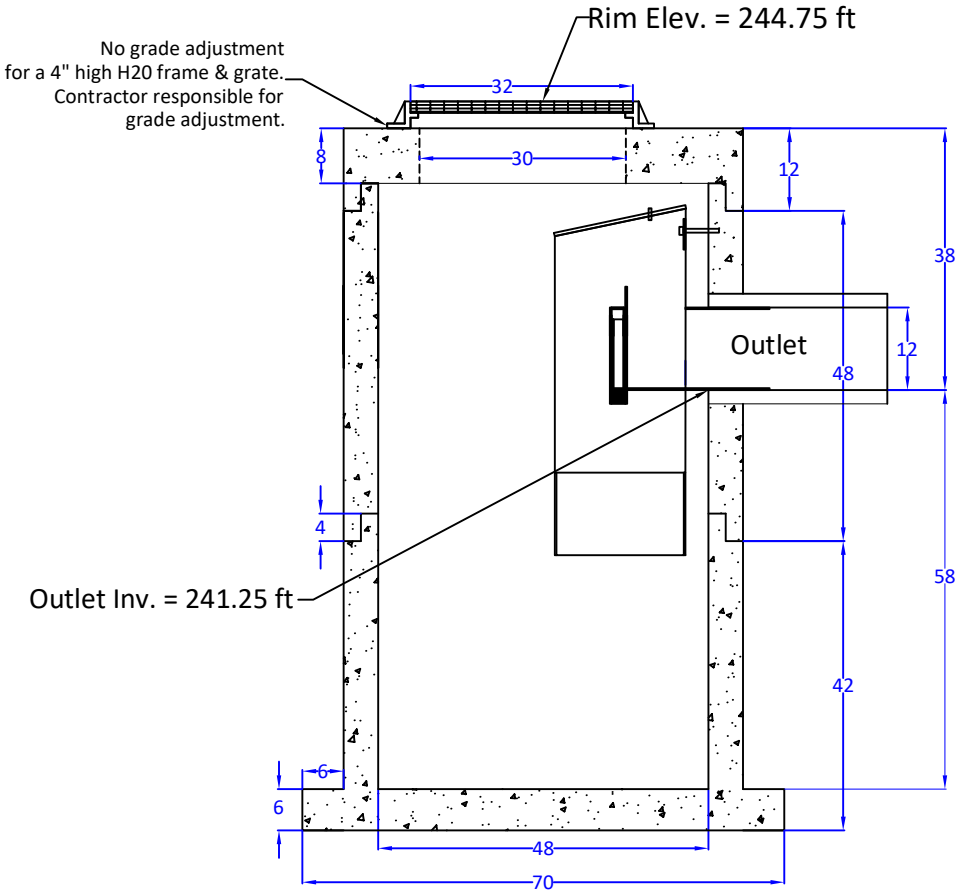


Profile

Any alternate equal must have independent testing to both the 2013 NJDEP separator protocol and the 2013 ETV Canada separator protocol

HydroDome by
Hydroworks, LLC
U.S. Patent #10,801,196
www.hydroworks.com
888-290-7900

Hydroworks HD4i (48"Ø)	
PROJECT: 39 Alder (WQ-2)	
LOCATION: Medway, MA	
REVISION DATE: 3/3/2023	

Hydroworks

APPENDIX 3

Sizing Outputs

Hydroworks Sizing Summary

ETS Equipment Rental - Half of Roof
39 Alder Street, Medway, MA

03-02-2023

Recommended Size: HydroFilter HF2

A HydroFilter HF2 is recommended to provide 80 % annual TSS removal based on a drainage area of .07 (ac) with an imperviousness of 100 % and Worcester Wso Ap, Massachusetts rainfall for the User defined particle size distribution.

The recommended HydroFilter HF2 treats 97 % of the annual runoff and provides 88 % annual TSS removal for the Worcester Wso Ap rainfall records and User defined particle size distribution.

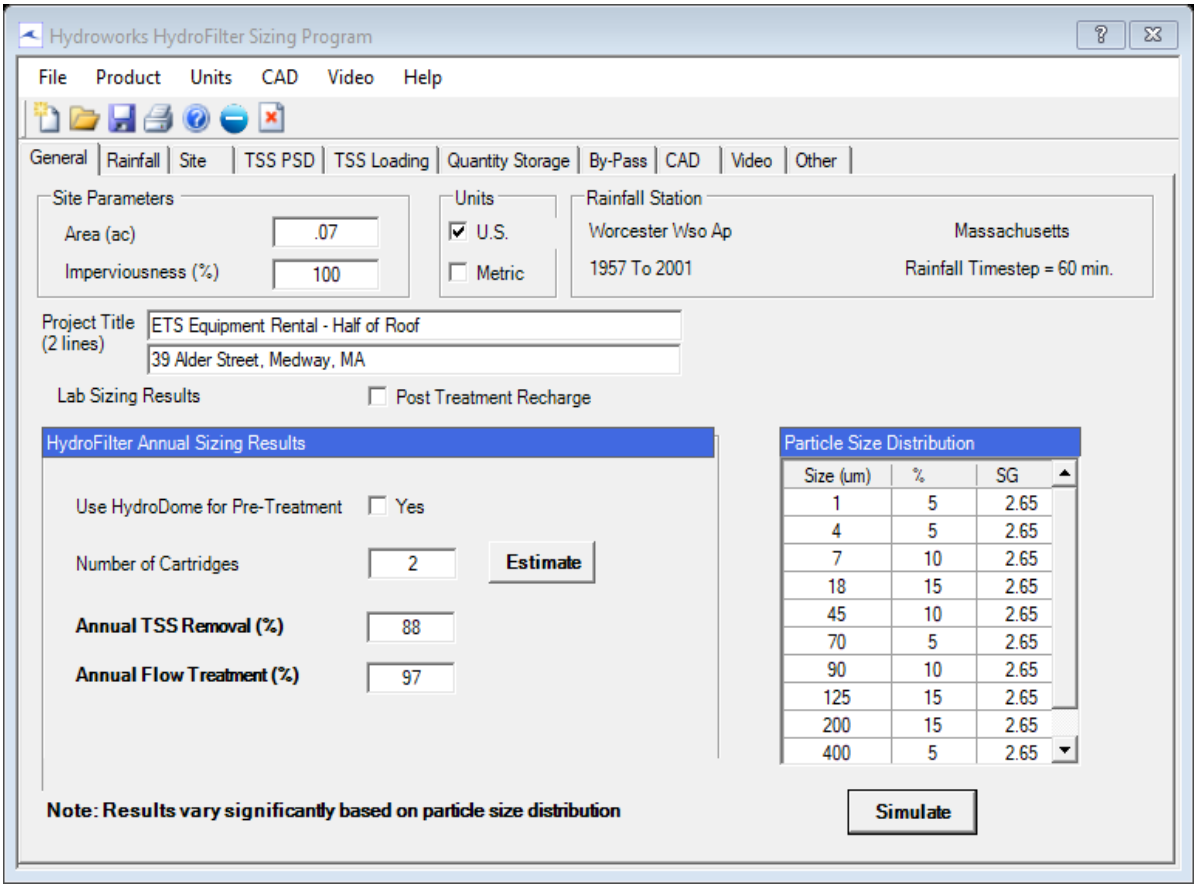
The HydroDome has a siphon which creates a discontinuity in headloss. Since a peak flow was not specified, headloss was calculated using the full pipe flow of 2.52 (ft3/s) for the given 12 (in) pipe diameter at .5% slope. The headloss was calculated to be 11 (in) above the crown of the 12 (in) outlet pipe.

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

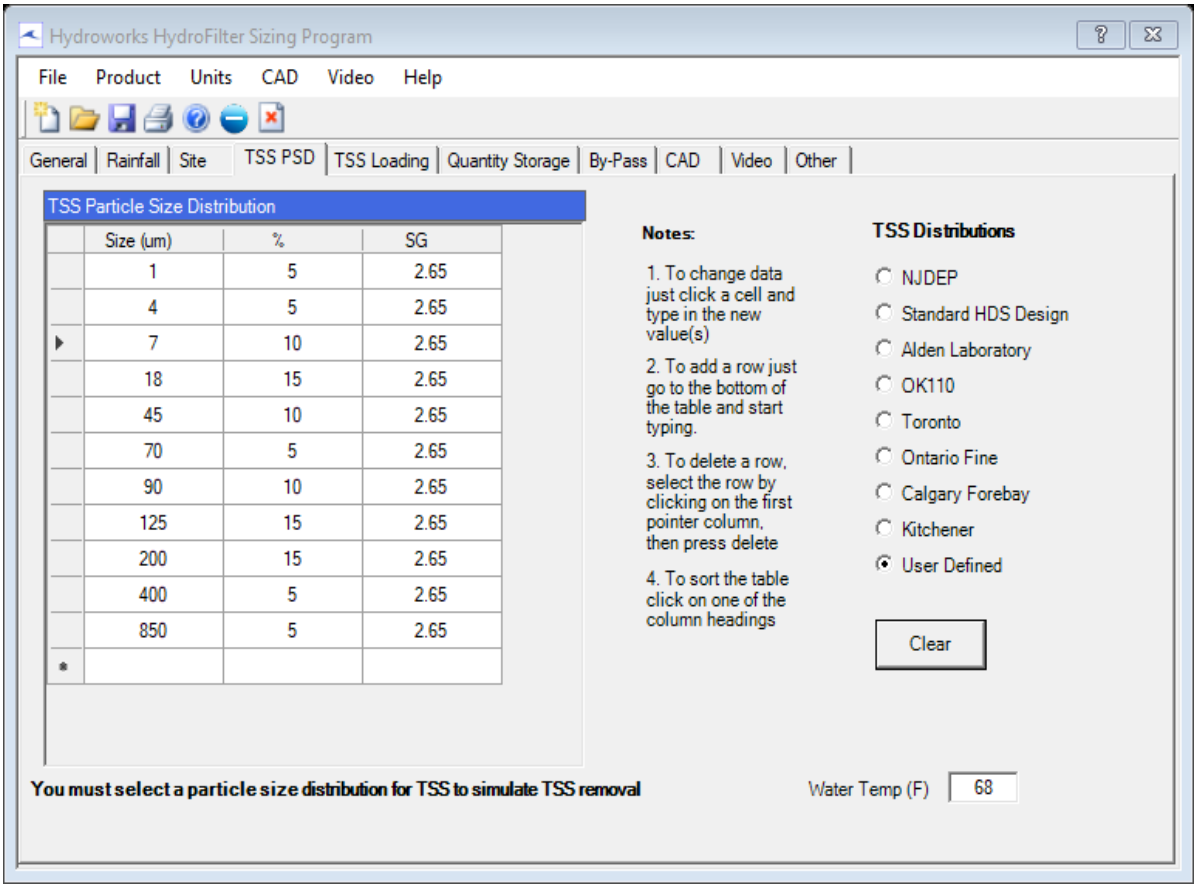
If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroFilter .

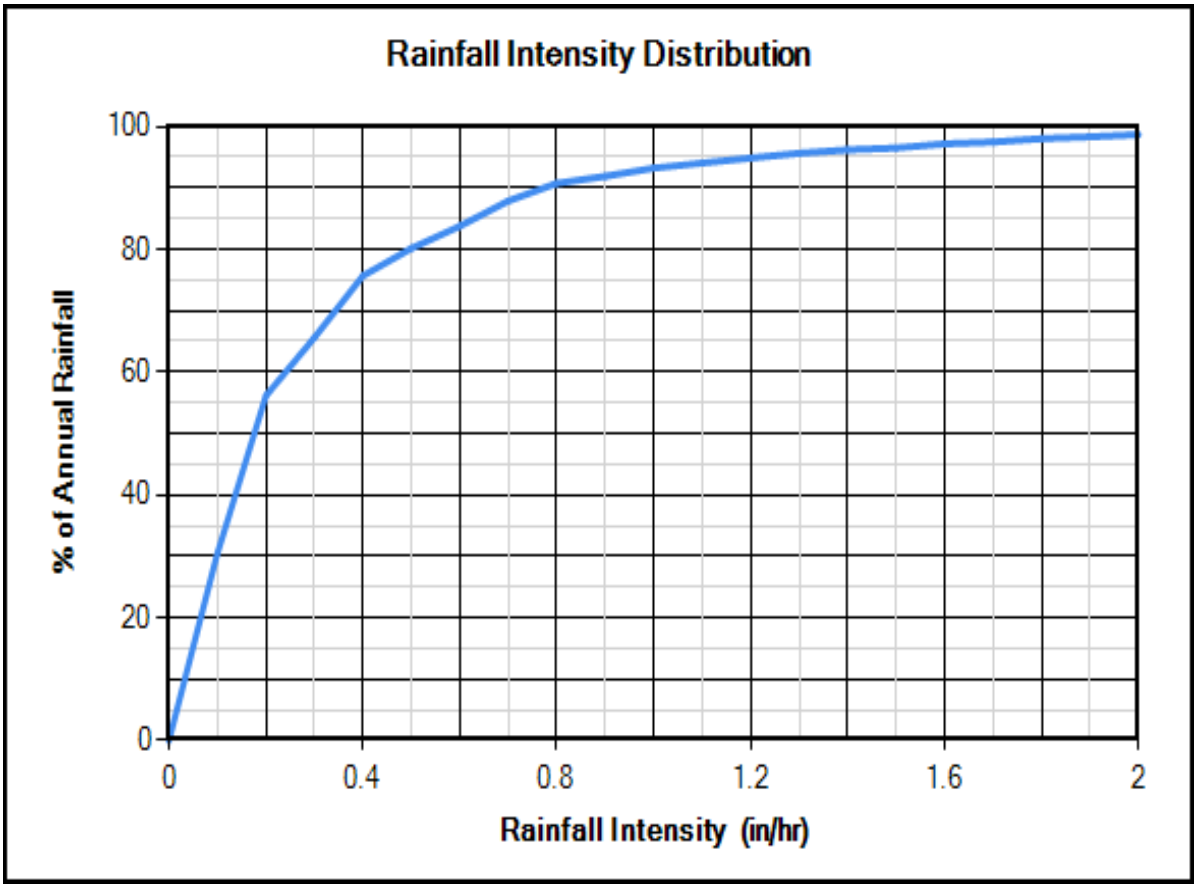
TSS Removal Sizing Summary



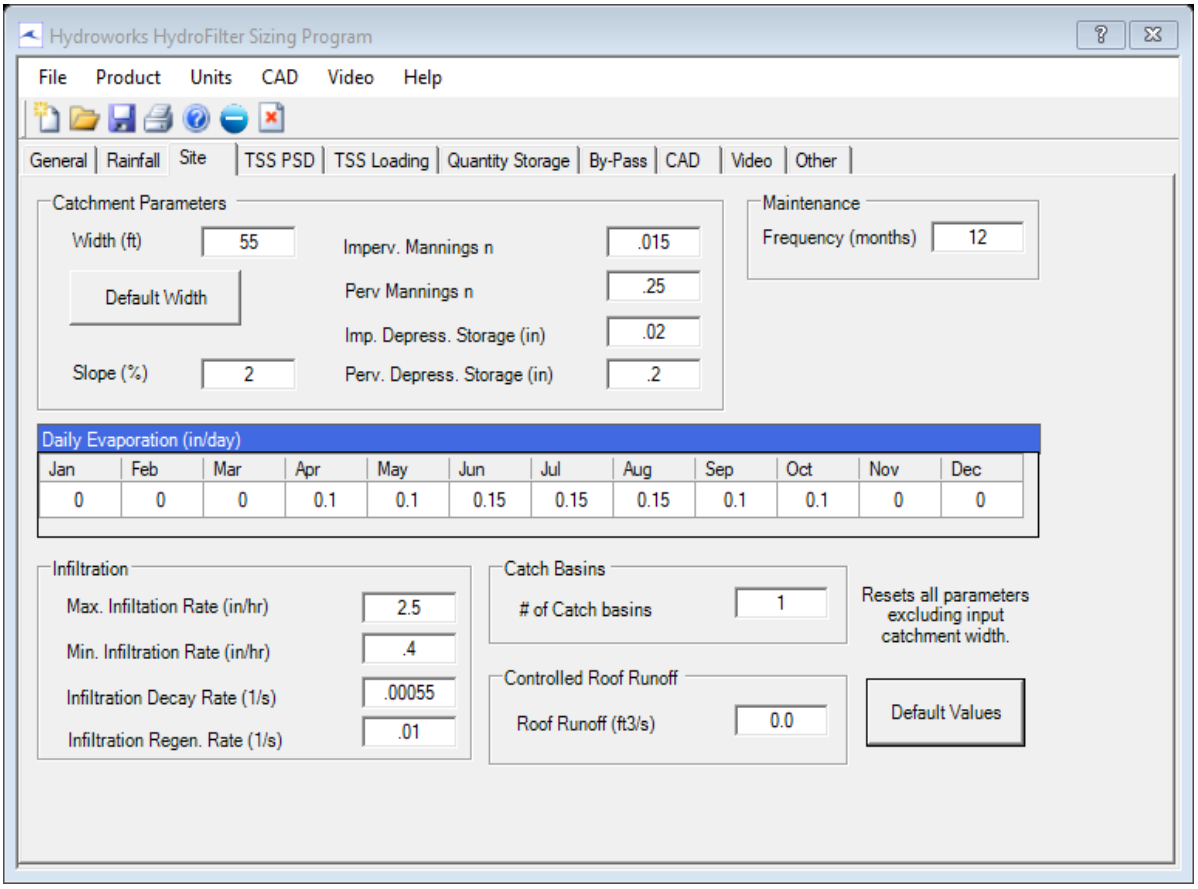
TSS Particle Size Distribution



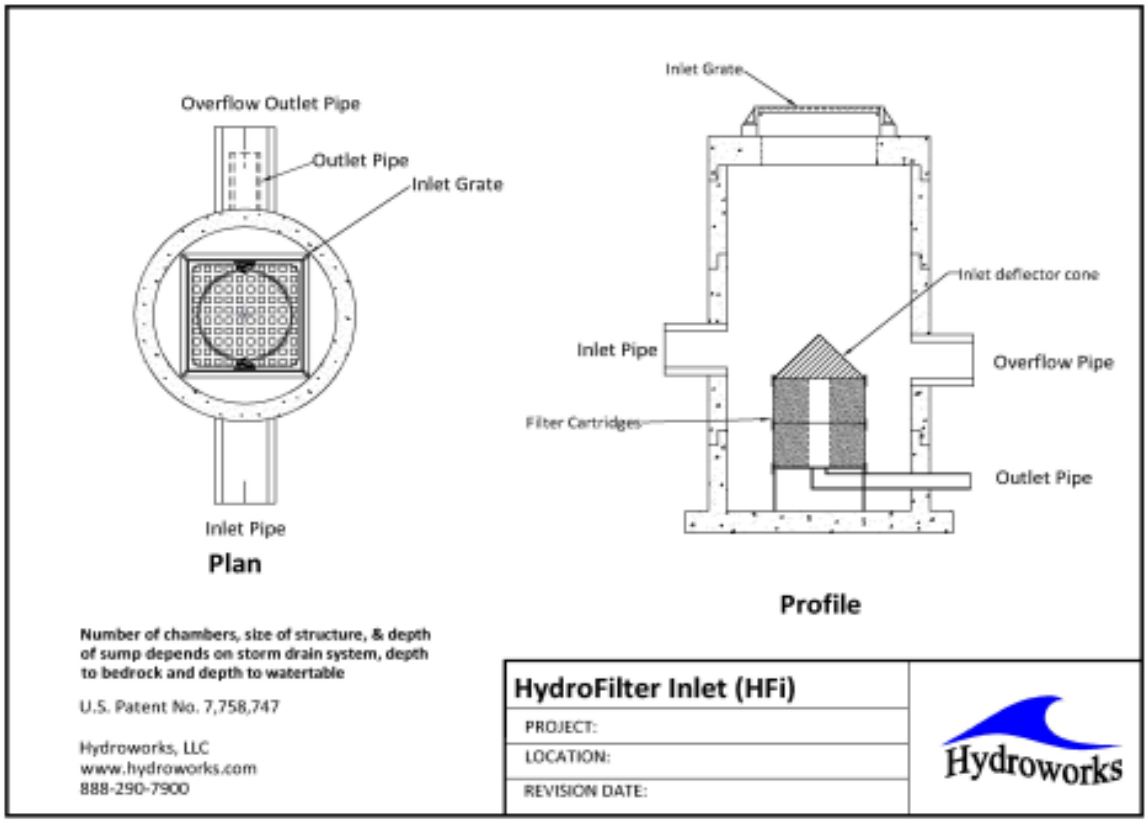
Rainfall Station - Worcester Wso Ap, Massachusetts(1957 To 2001)



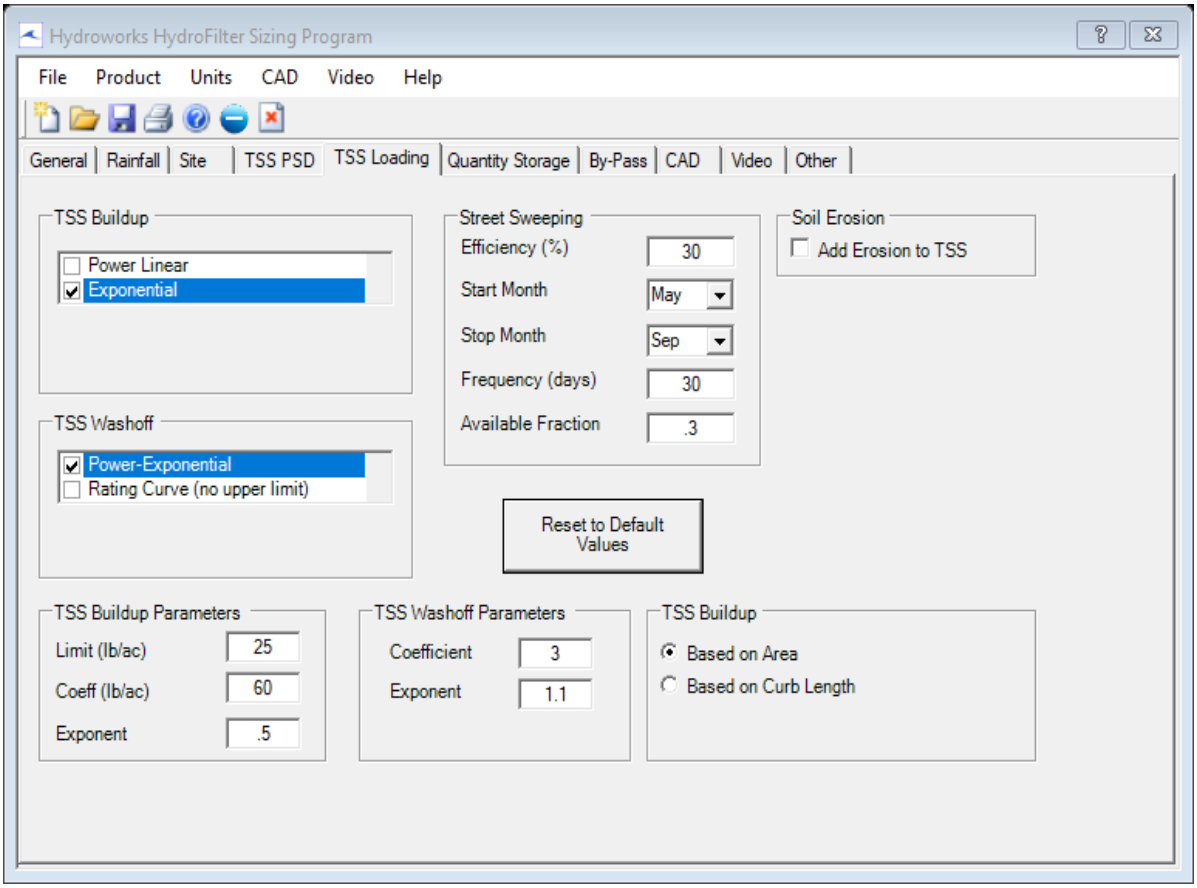
Site Physical Characteristics



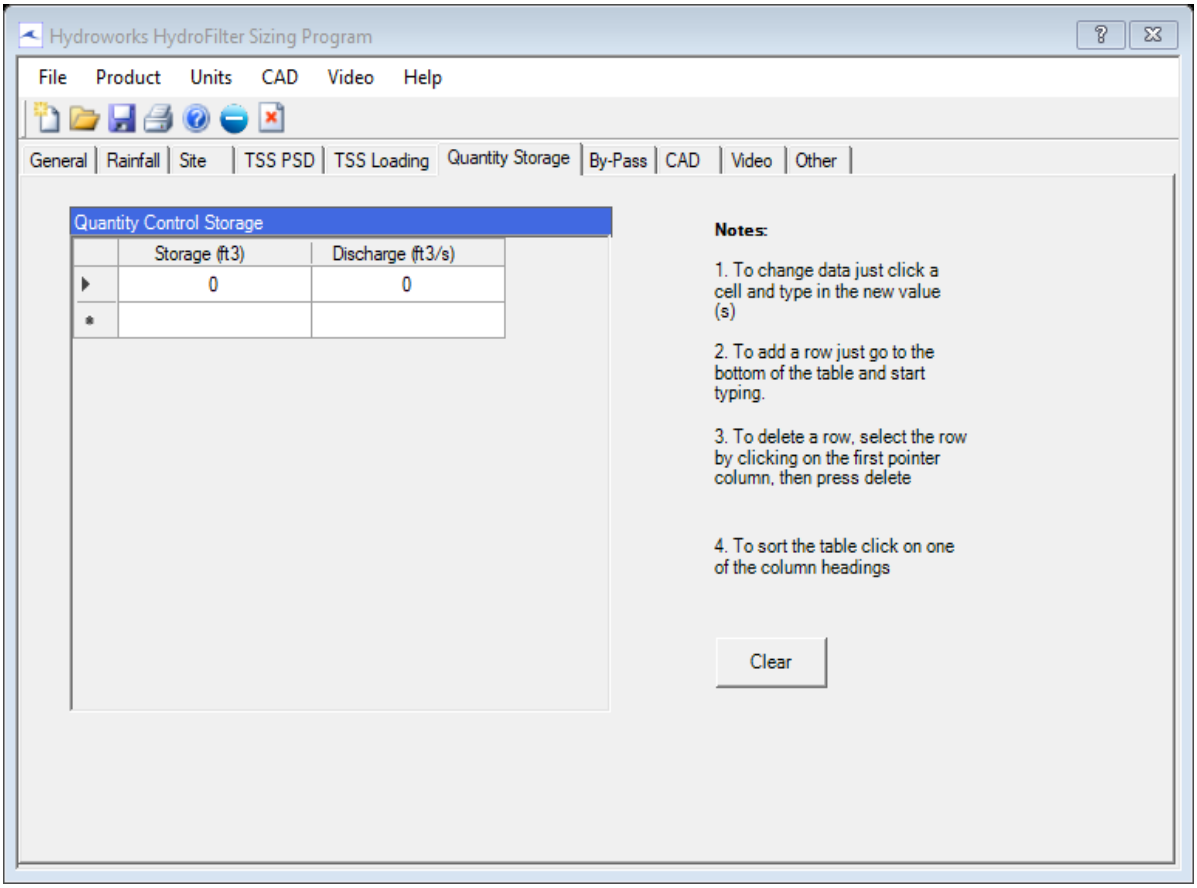
Generic HF2 CAD Drawing



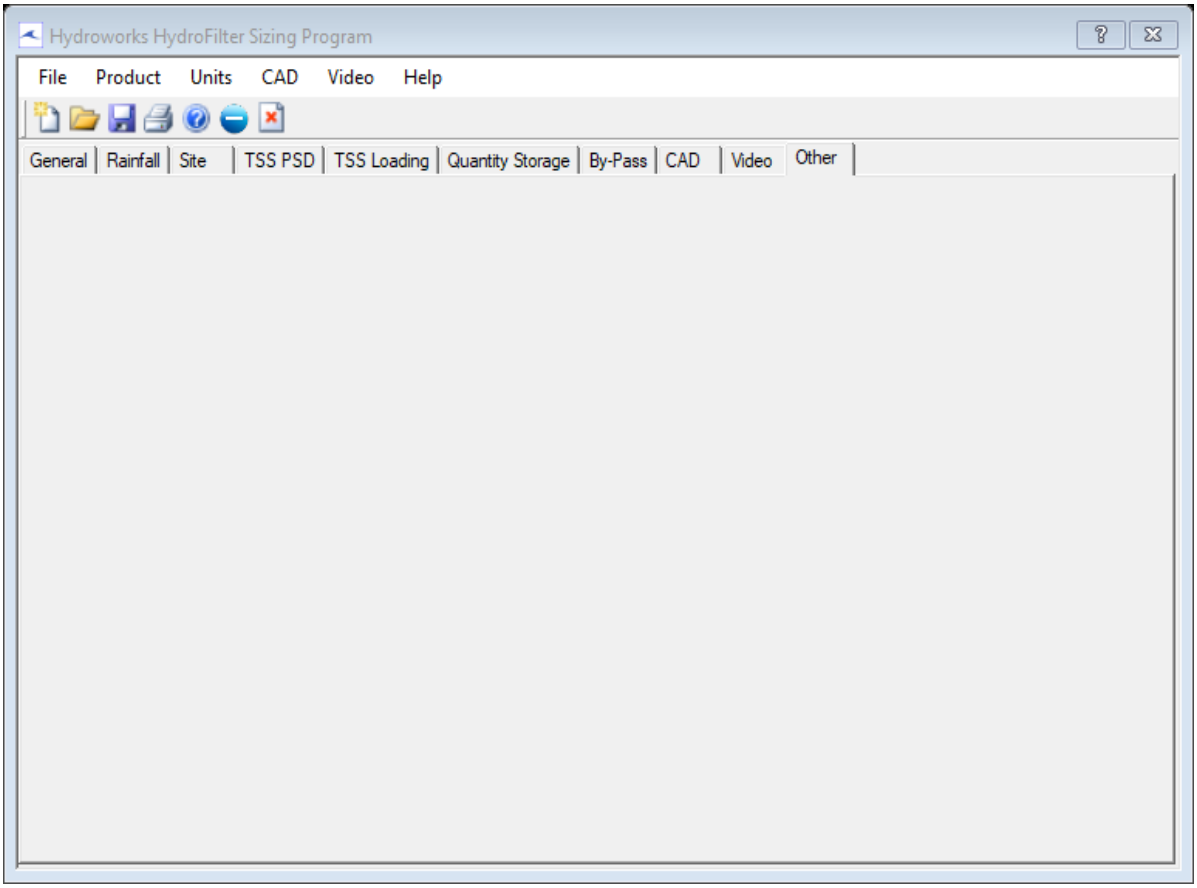
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Flagged Issues

None

Hydroworks Sizing Summary

ETS Equipment Rental WQ-1
39 Alder Street, Medway, MA

03-02-2023

Recommended Size: HydroDome HD 4

A HydroDome HD 4 is recommended to provide 83 % annual TSS removal based on a drainage area of .9 (ac) with an imperviousness of 90 % and Worcester Wso Ap, Massachusetts rainfall for the NJDEP particle size distribution.

The recommended HydroDome HD 4 treats 100 % of the annual runoff and provides 83 % annual TSS removal for the Worcester Wso Ap rainfall records and NJDEP particle size distribution.

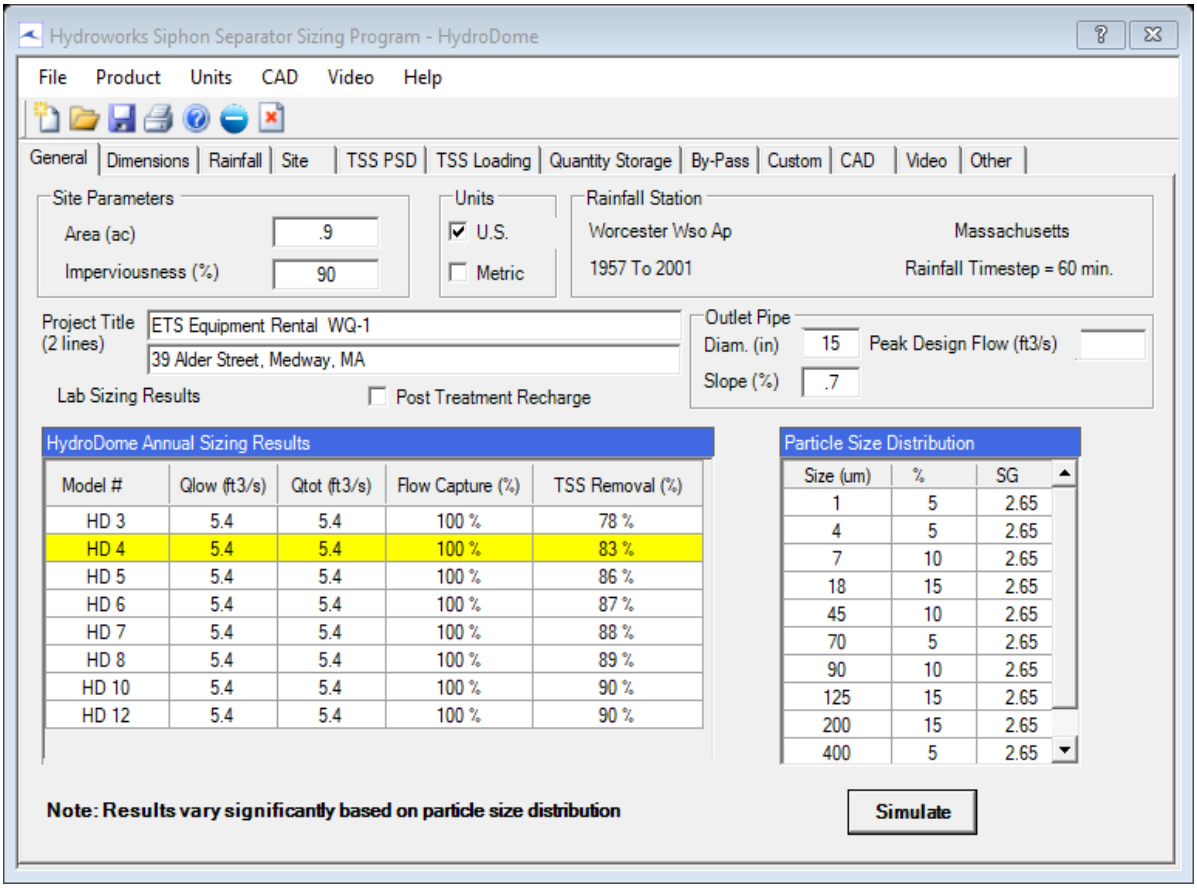
The HydroDome has a siphon which creates a discontinuity in headloss. Since a peak flow was not specified, headloss was calculated using the full pipe flow of 5.4 (ft3/s) for the given 15 (in) pipe diameter at .7% slope. The headloss was calculated to be 15 (in) above the crown of the 15 (in) outlet pipe.

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

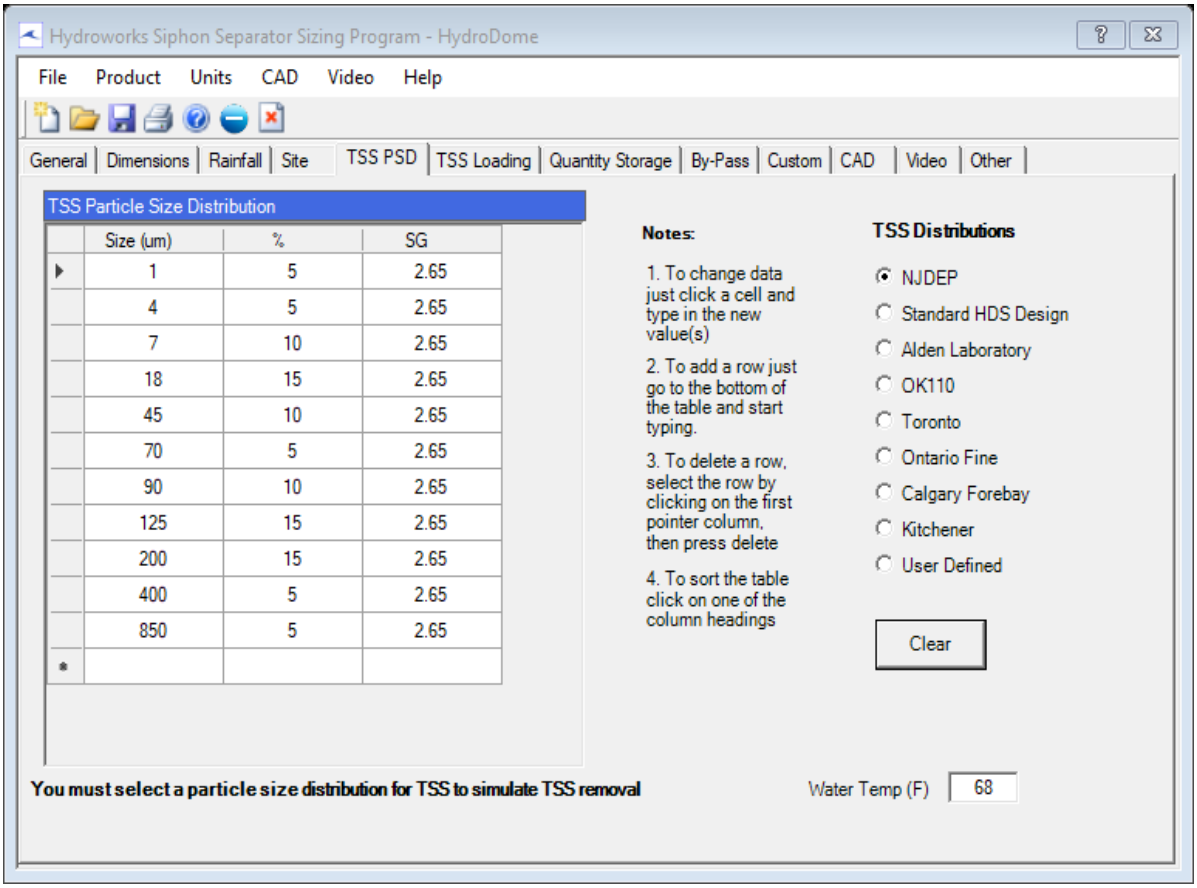
If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroDome .

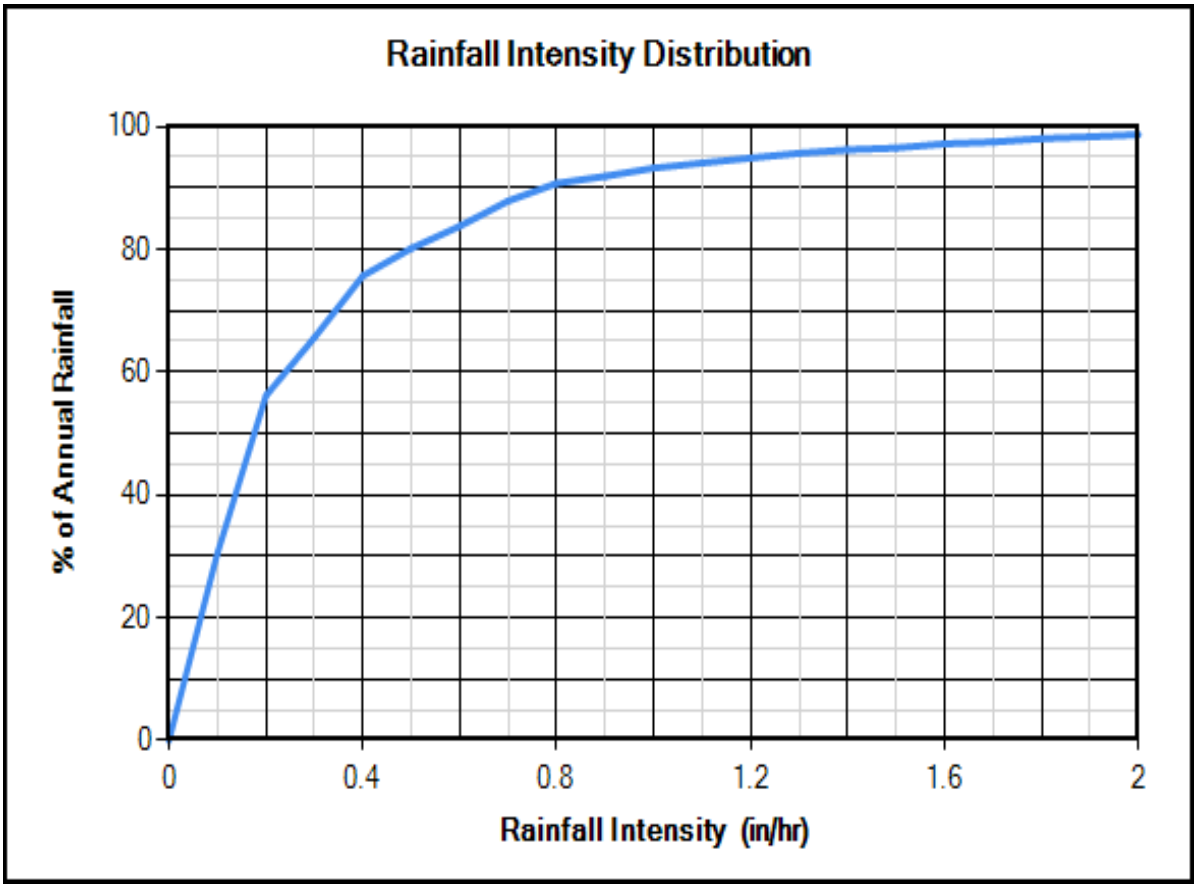
TSS Removal Sizing Summary



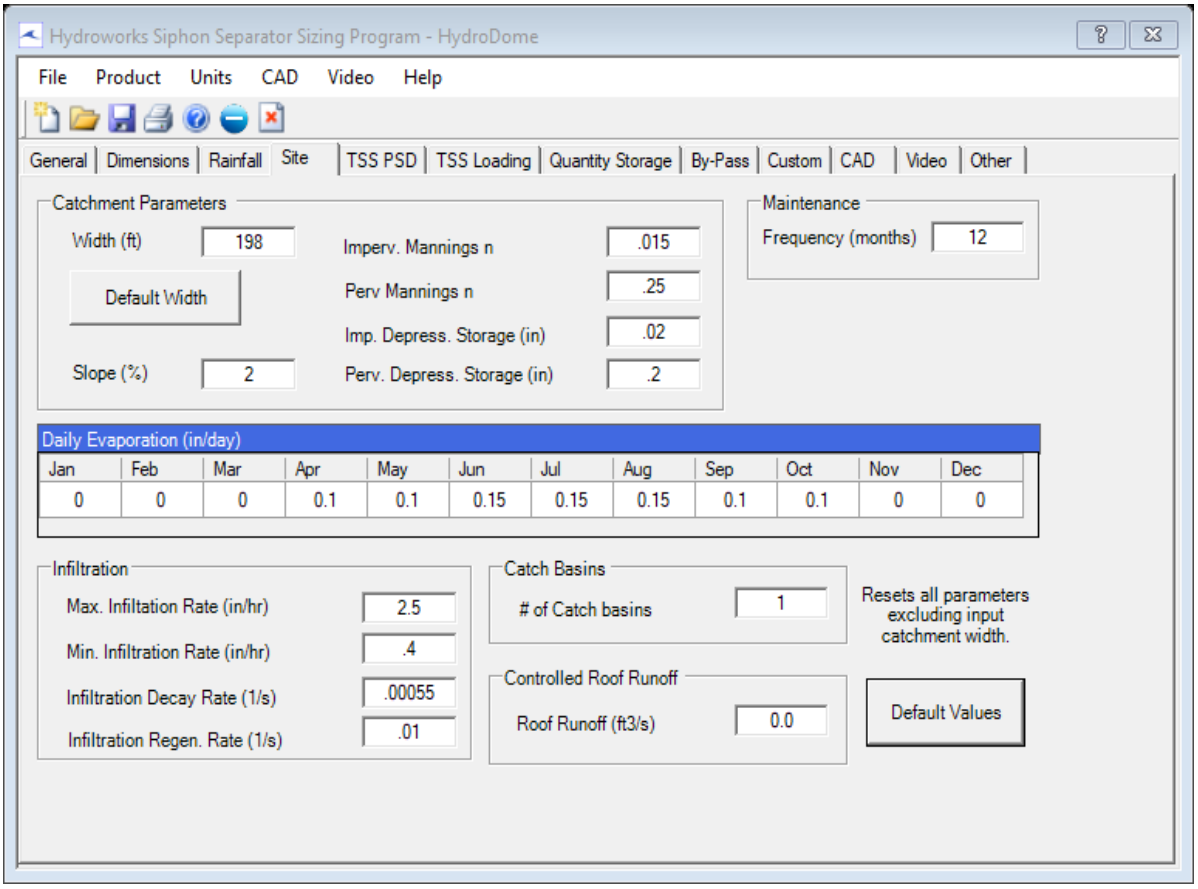
TSS Particle Size Distribution



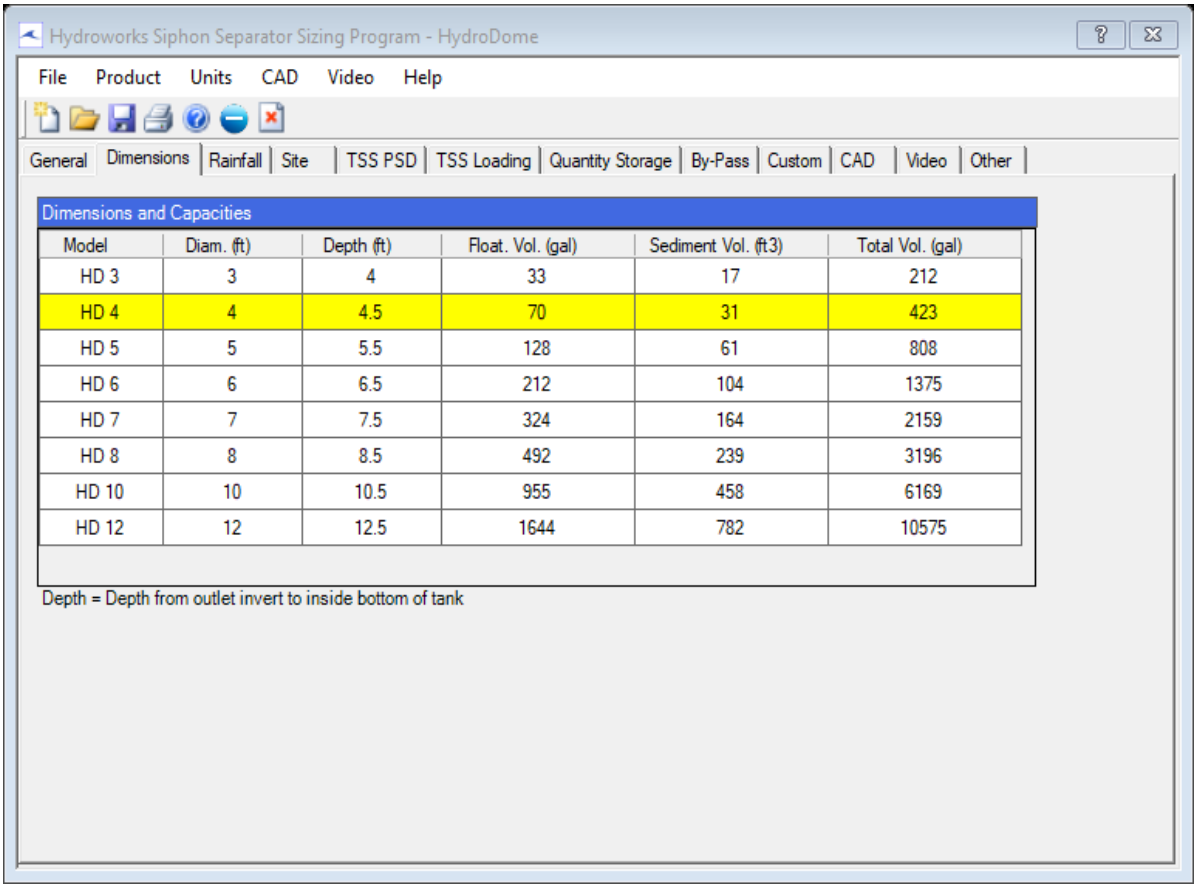
Rainfall Station - Worcester Wso Ap, Massachusetts(1957 To 2001)



Site Physical Characteristics



Dimensions And Capacities

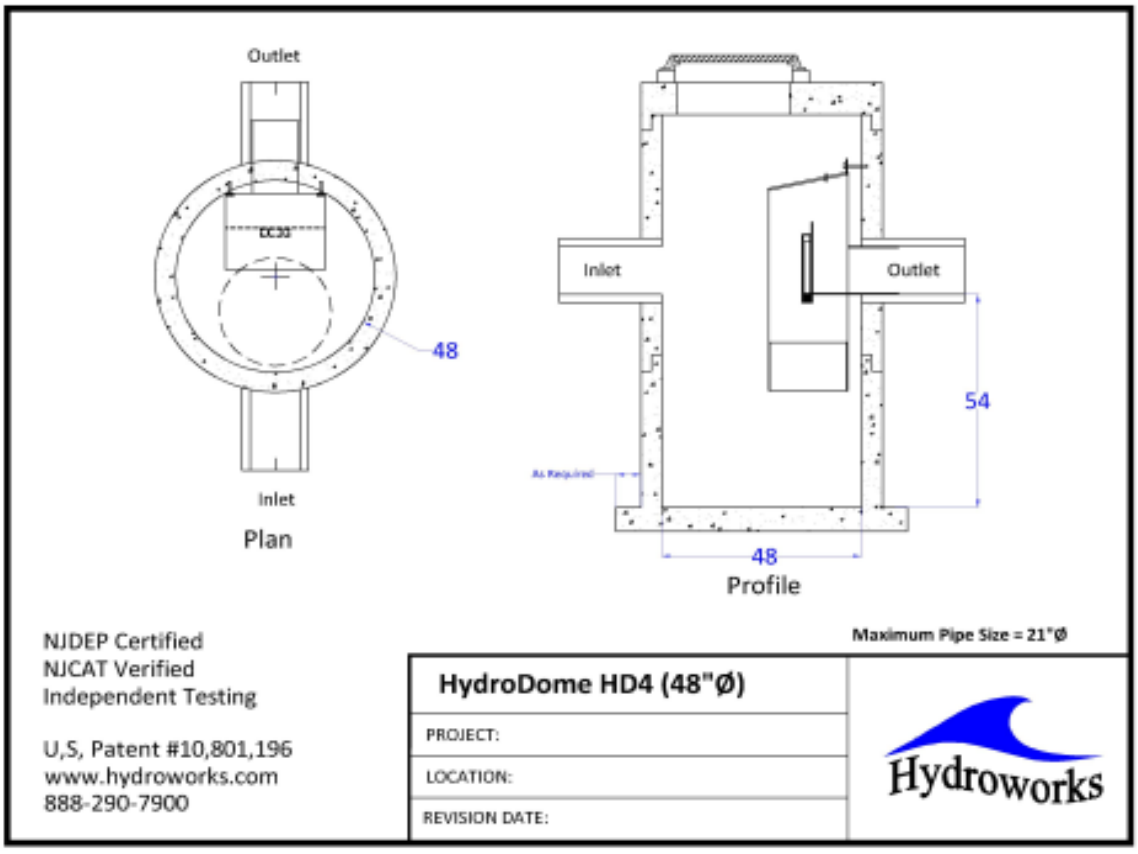


Dimensions and Capacities

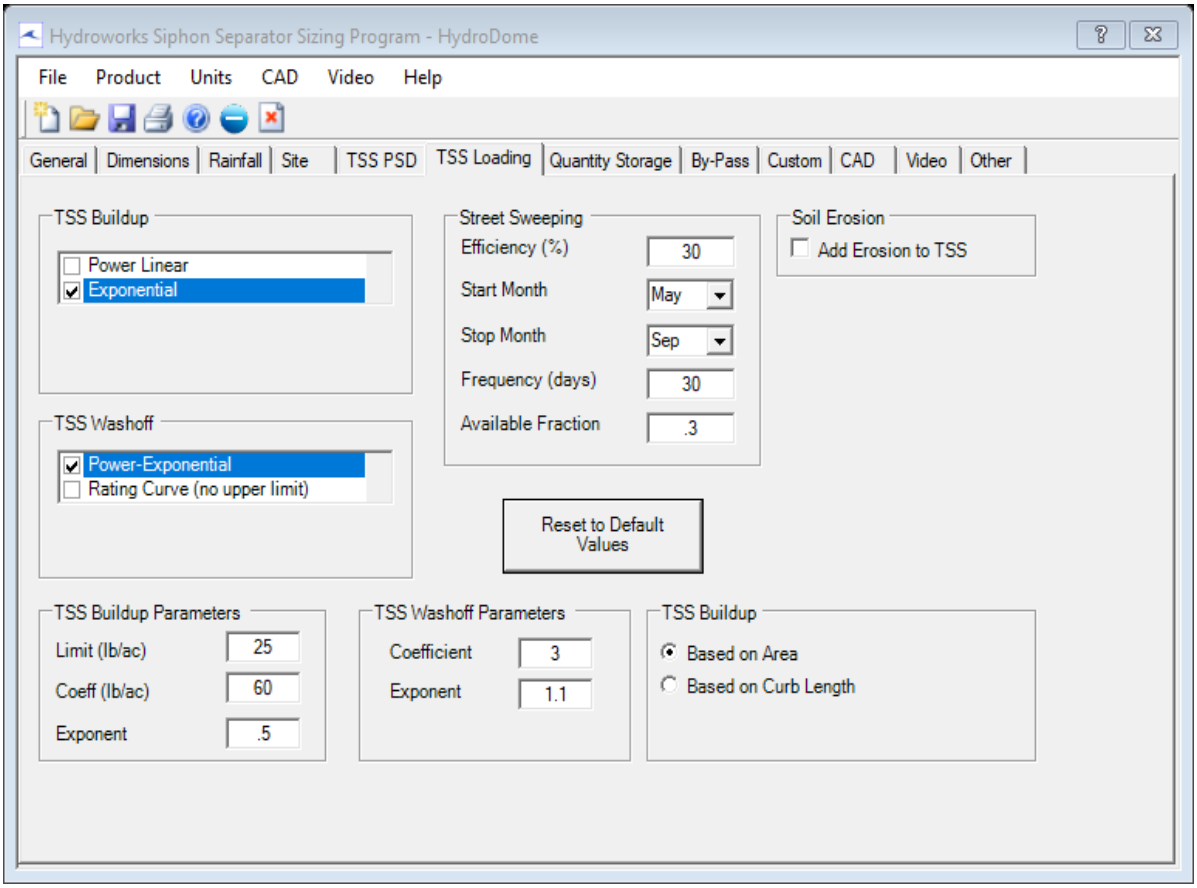
Model	Diam. (ft)	Depth (ft)	Float. Vol. (gal)	Sediment Vol. (ft3)	Total Vol. (gal)
HD 3	3	4	33	17	212
HD 4	4	4.5	70	31	423
HD 5	5	5.5	128	61	808
HD 6	6	6.5	212	104	1375
HD 7	7	7.5	324	164	2159
HD 8	8	8.5	492	239	3196
HD 10	10	10.5	955	458	6169
HD 12	12	12.5	1644	782	10575

Depth = Depth from outlet invert to inside bottom of tank

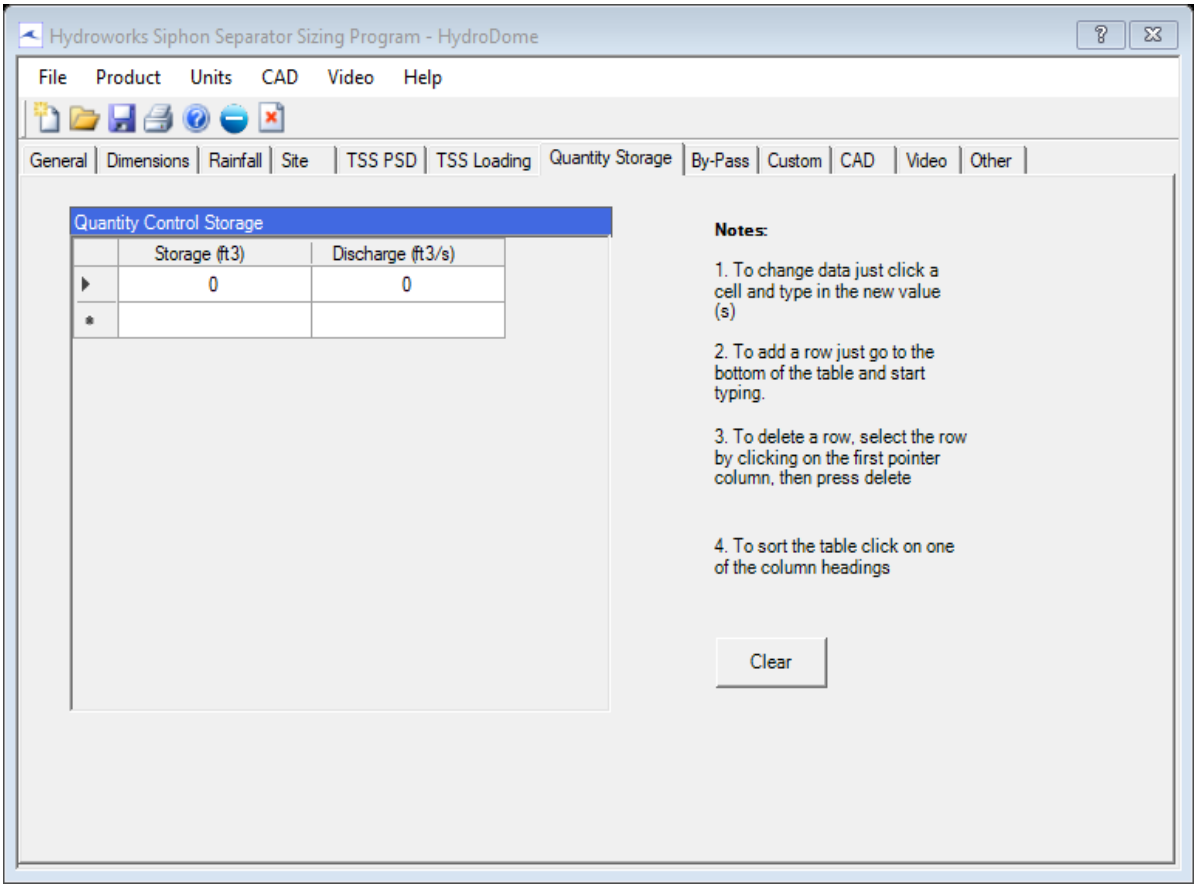
Generic HD 4 CAD Drawing



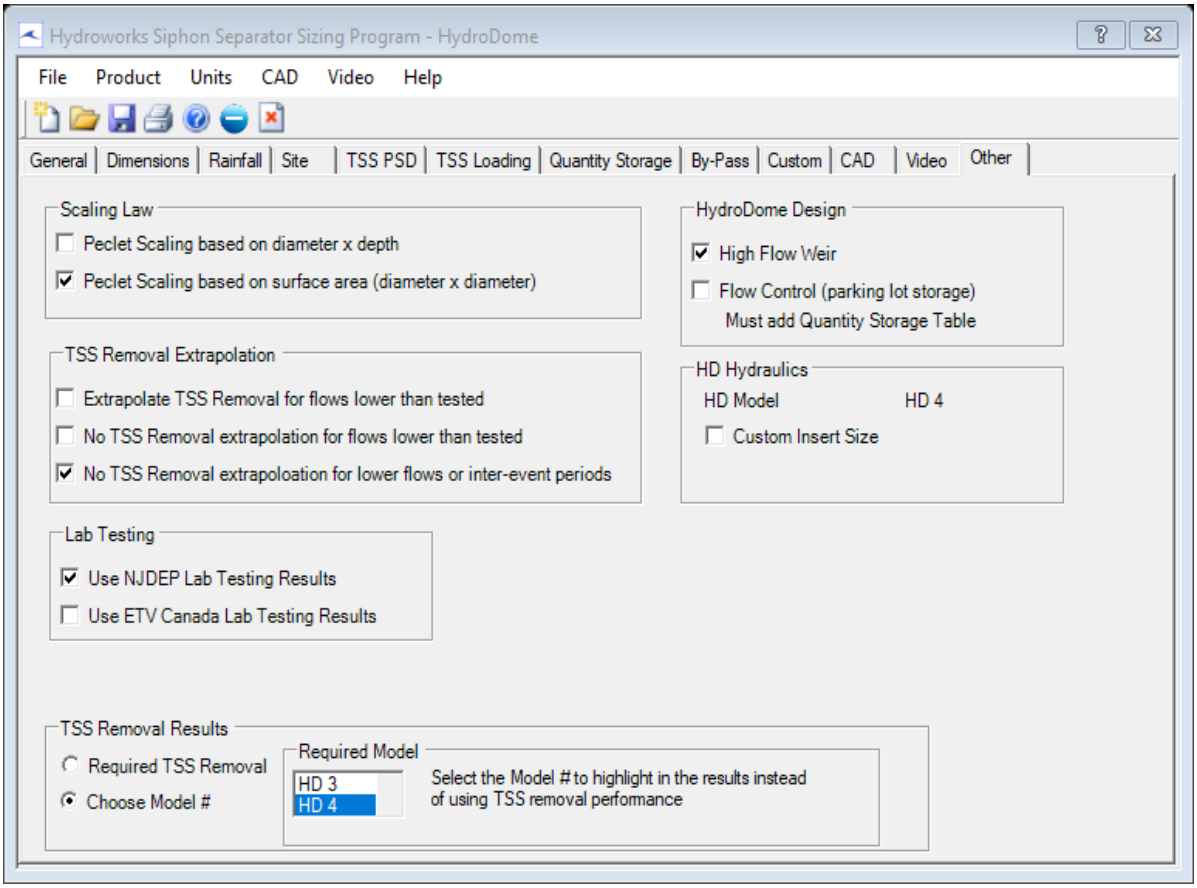
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Flagged Issues

If there is underground detention storage upstream of the HydroDome please contact Hydroworks to ensure it has been modeled correctly.

Hydroworks Sizing Program - Version 5.8

1-800-290-7900
www.hydroworks.com

Hydroworks Sizing Summary

ETS Equipment Rental WQ-2
39 Alder Street, Medway, MA

03-02-2023

Recommended Size: HydroDome HD 4i

A HydroDome HD 4i is recommended to provide 88 % annual TSS removal based on a drainage area of .31 (ac) with an imperviousness of 100 % and Worcester Wso Ap, Massachusetts rainfall for the NJDEP particle size distribution.

The recommended HydroDome HD 4i treats 100 % of the annual runoff and provides 88 % annual TSS removal for the Worcester Wso Ap rainfall records and NJDEP particle size distribution.

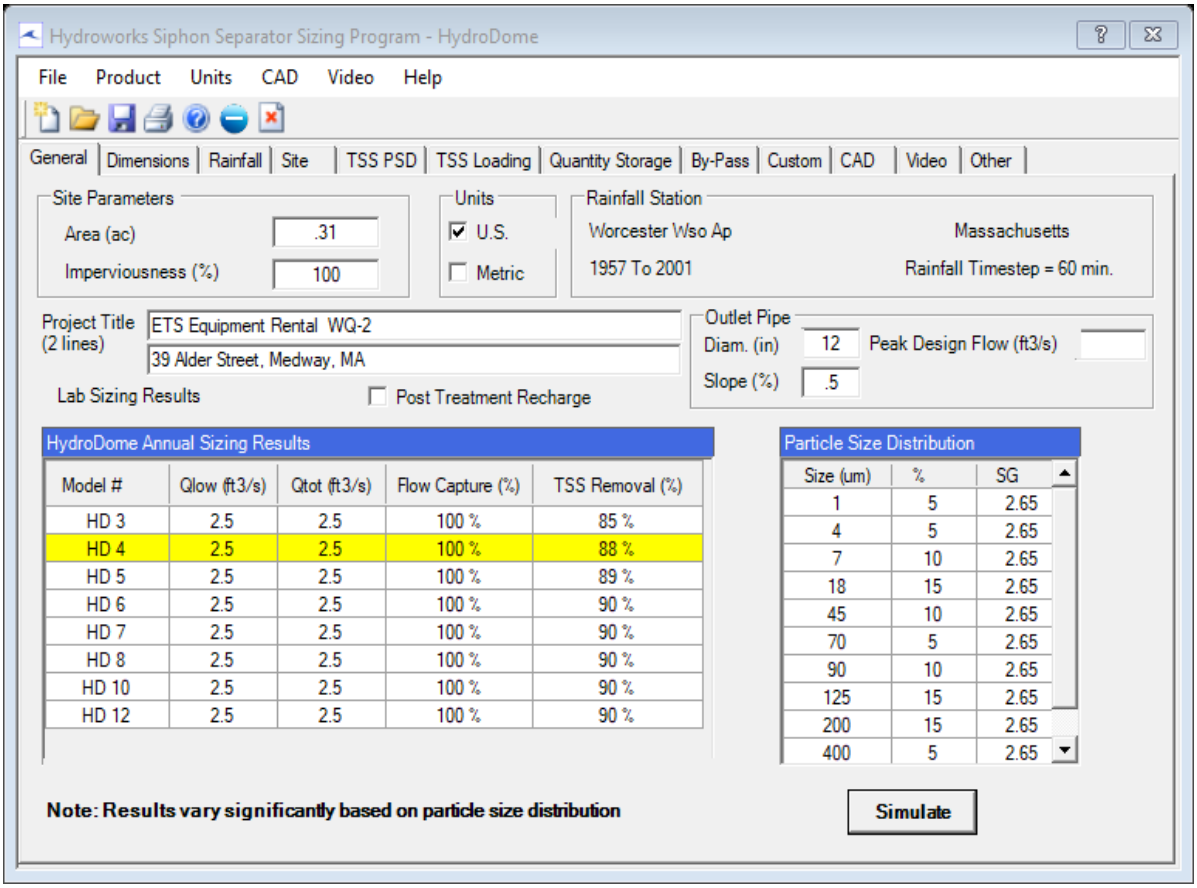
The HydroDome has a siphon which creates a discontinuity in headloss. Since a peak flow was not specified, headloss was calculated using the full pipe flow of 2.52 (ft3/s) for the given 12 (in) pipe diameter at .5% slope. The headloss was calculated to be 11 (in) above the crown of the 12 (in) outlet pipe.

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

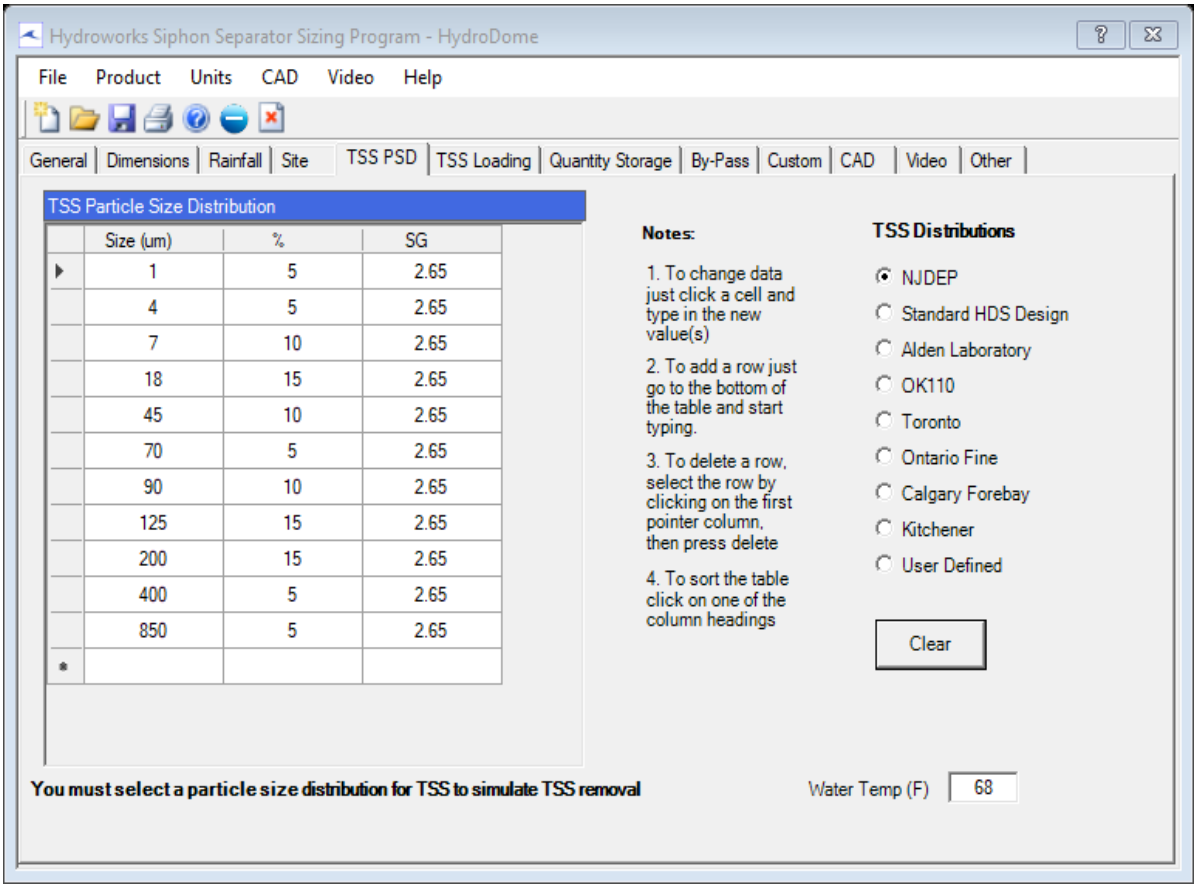
If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroDome .

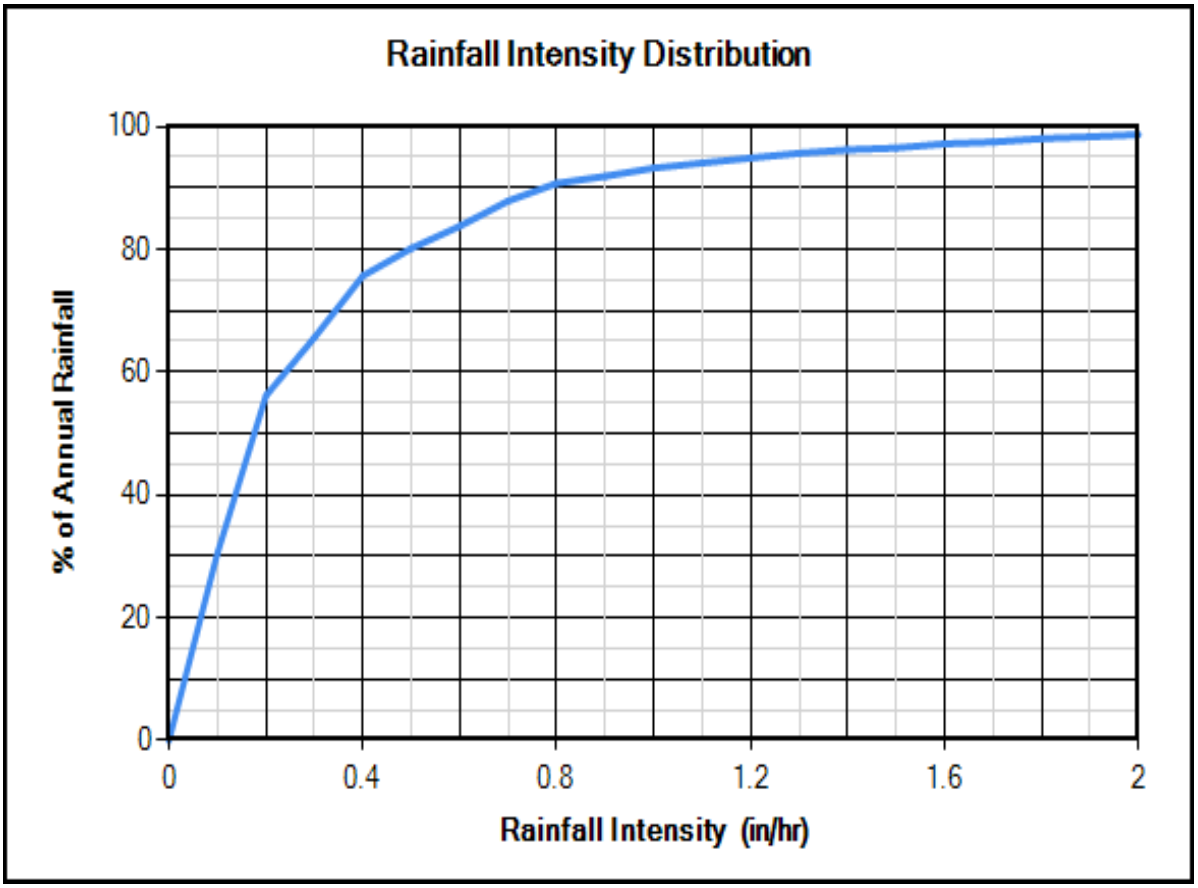
TSS Removal Sizing Summary



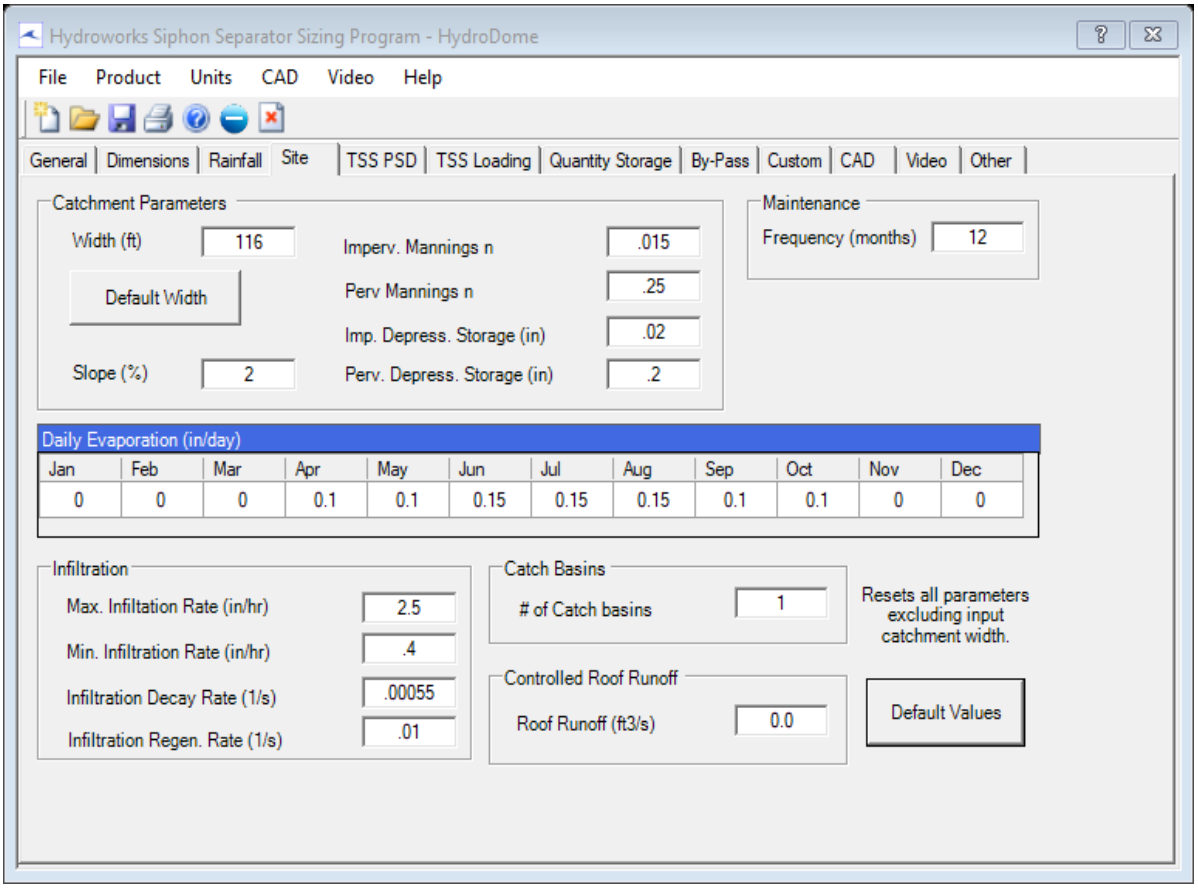
TSS Particle Size Distribution



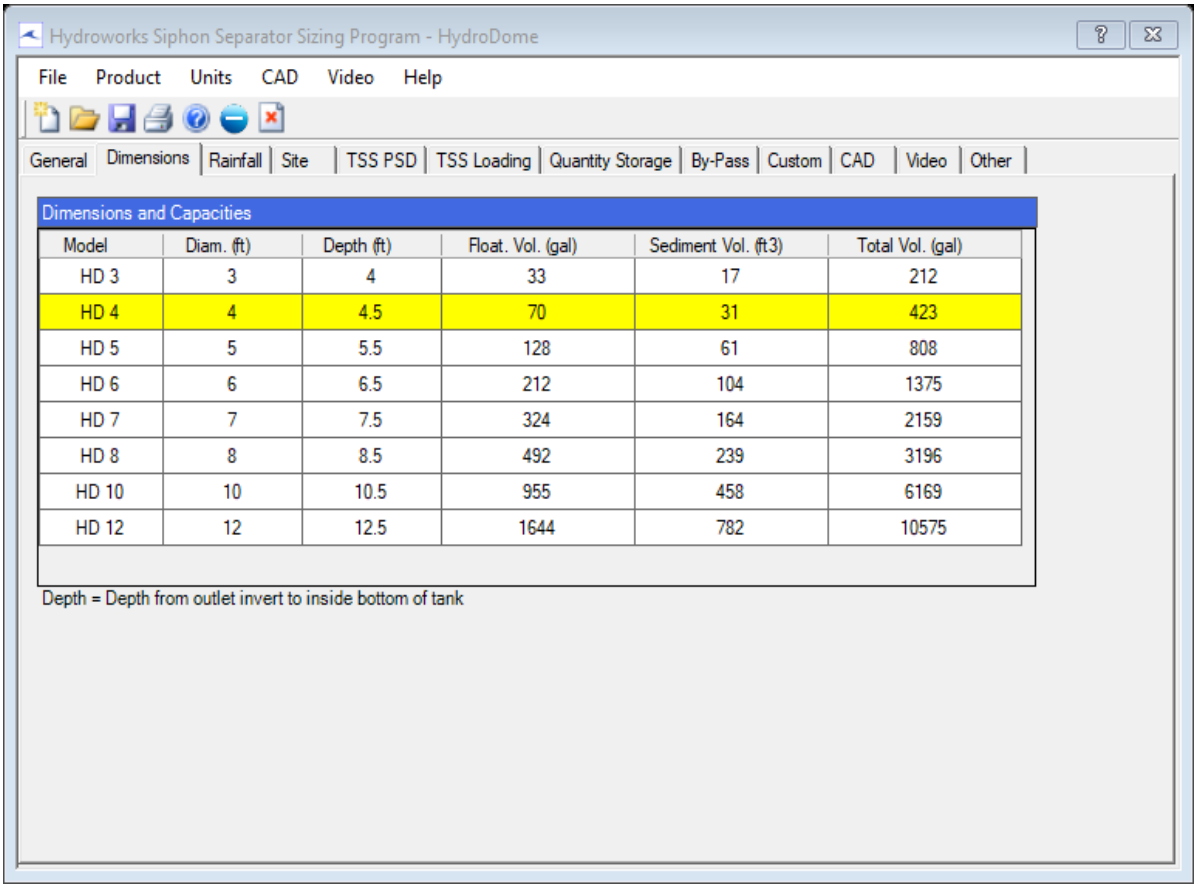
Rainfall Station - Worcester Wso Ap, Massachusetts(1957 To 2001)



Site Physical Characteristics



Dimensions And Capacities



Dimensions and Capacities

Model	Diam. (ft)	Depth (ft)	Float. Vol. (gal)	Sediment Vol. (ft3)	Total Vol. (gal)
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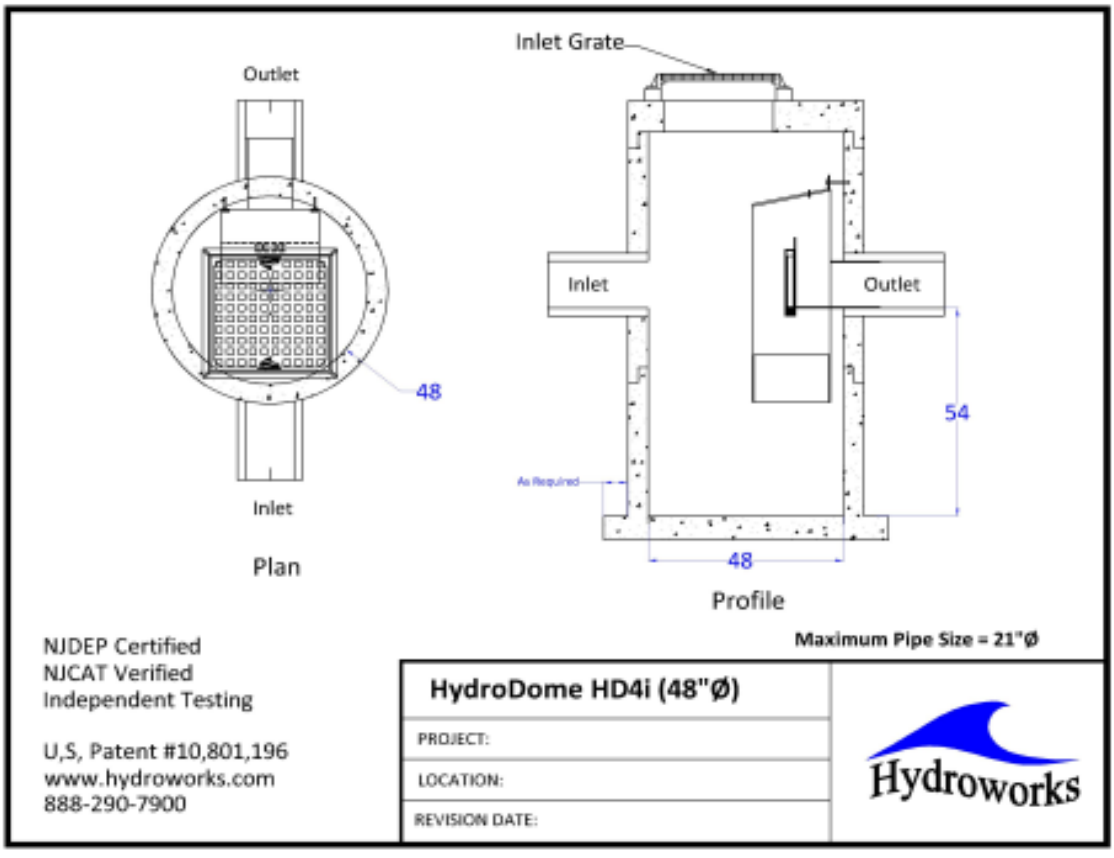
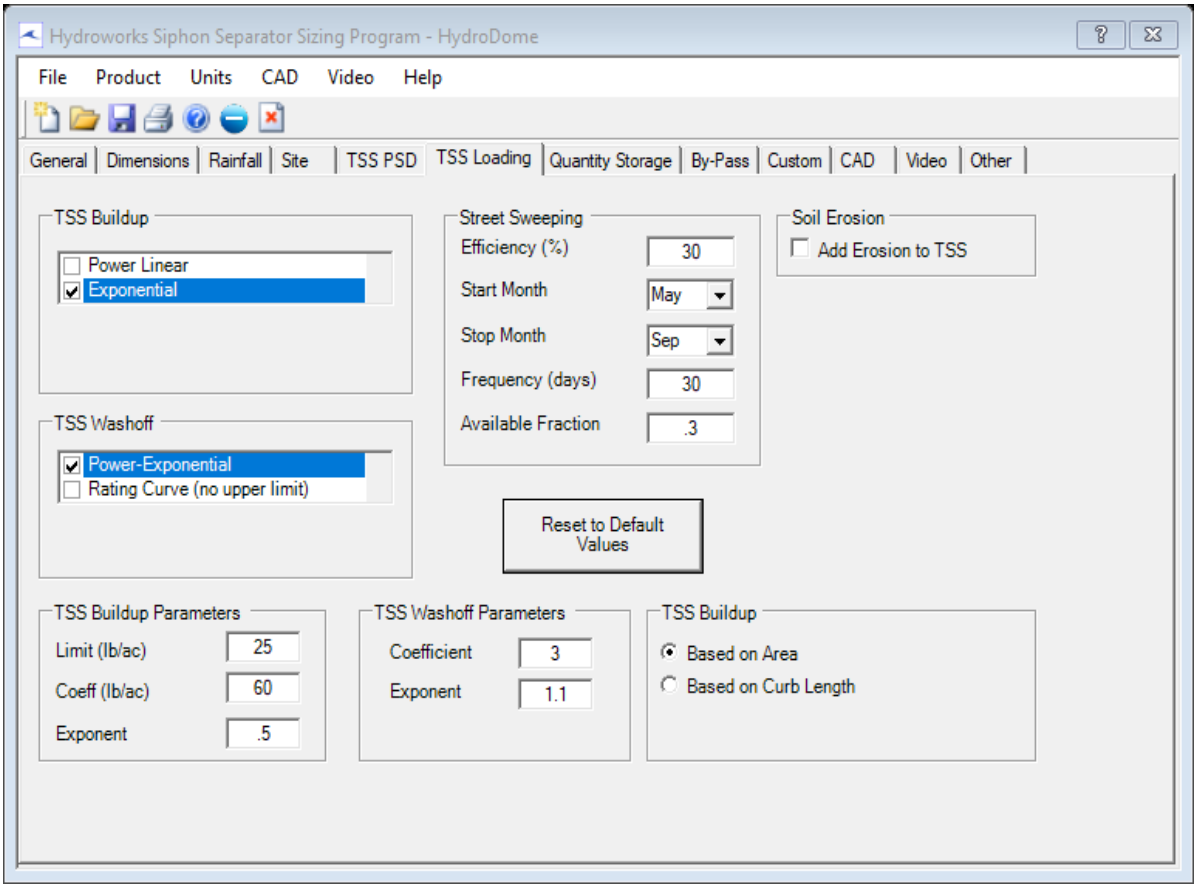
HD 10	10	10.5	955	458	6169
HD 12	12	12.5	1644	782	10575

Depth = Depth from outlet invert to inside bottom of tank

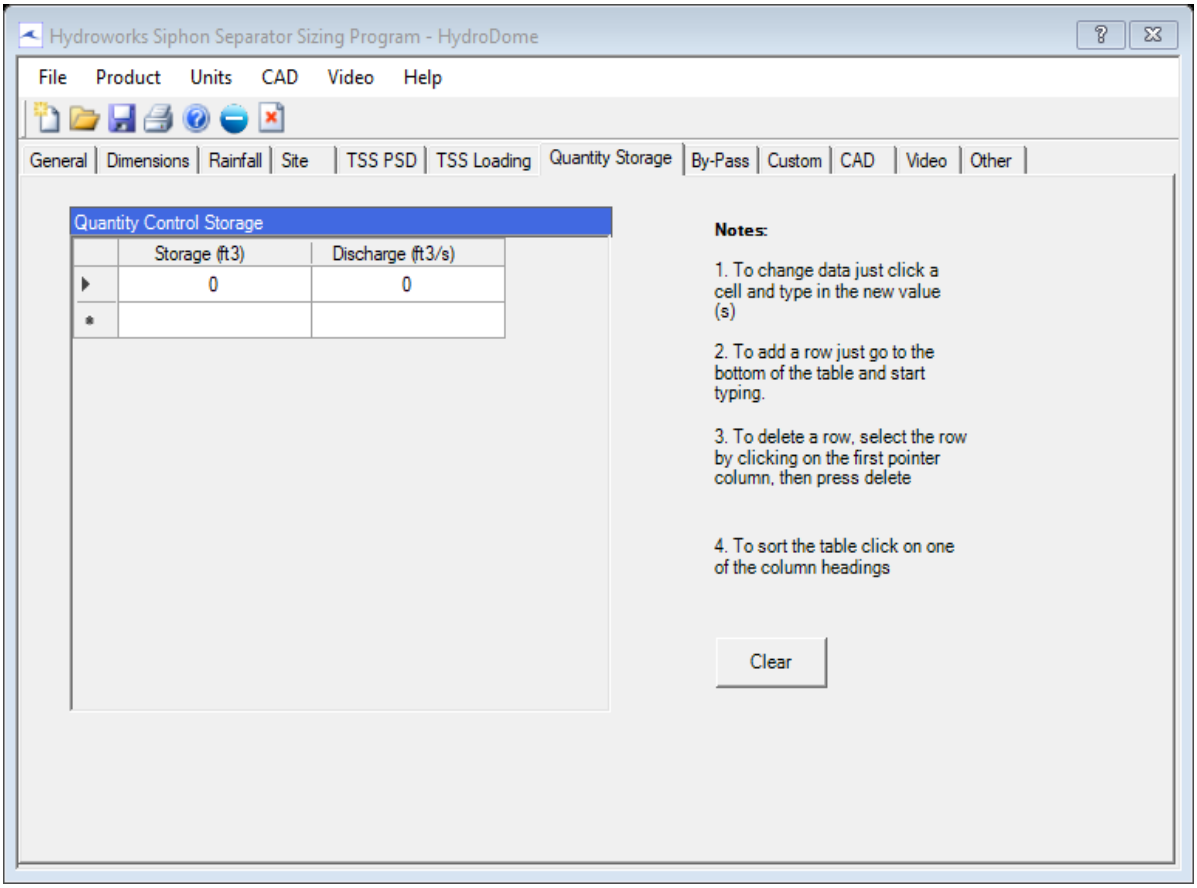
Generic HD 4i CAD Drawing



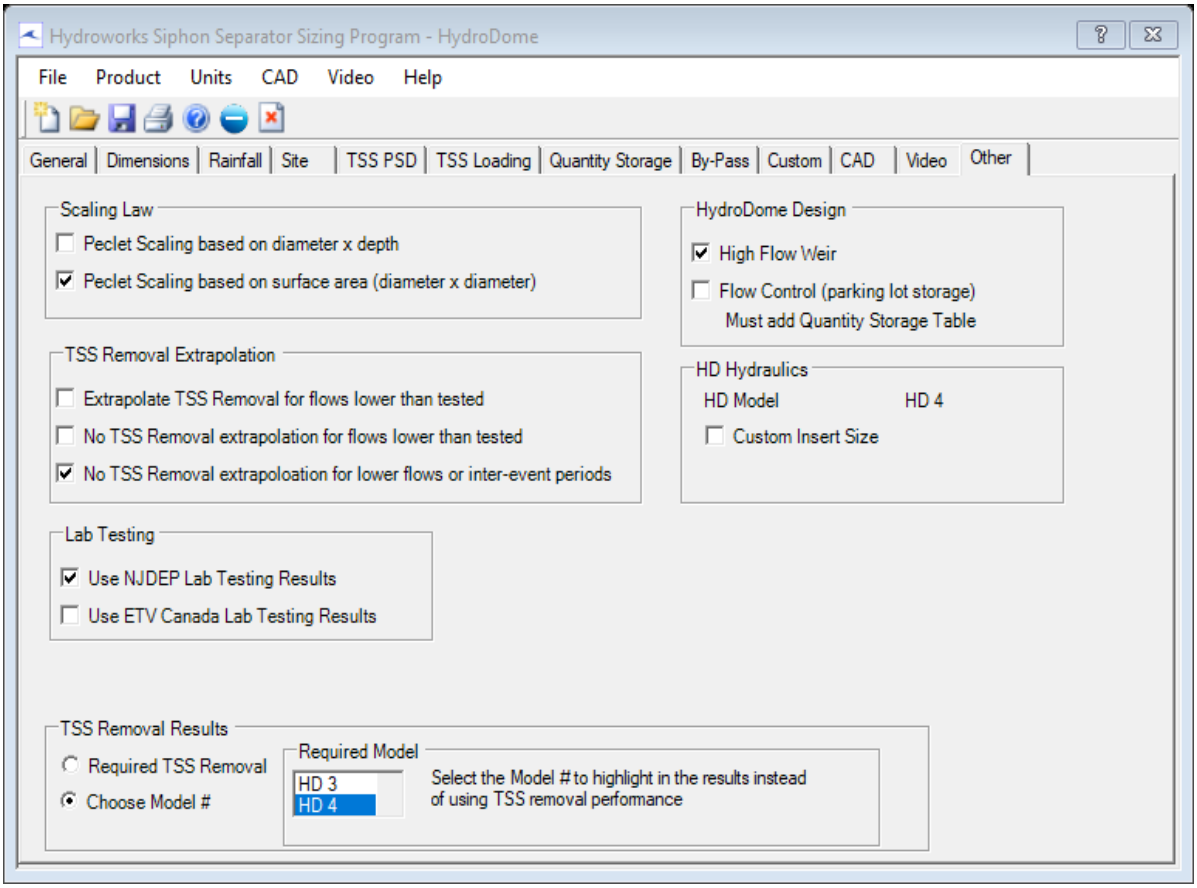
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Flagged Issues

If there is underground detention storage upstream of the HydroDome please contact Hydroworks to ensure it has been modeled correctly.

Hydroworks Sizing Program - Version 5.8

1-800-290-7900
www.hydroworks.com

Hydroworks Sizing Summary

ETS Equipment Rental WQ-3
39 Alder Street, Medway, MA

03-02-2023

Recommended Size: HydroDome HD 4i

A HydroDome HD 4i is recommended to provide 87 % annual TSS removal based on a drainage area of .42 (ac) with an imperviousness of 100 % and Worcester Wso Ap, Massachusetts rainfall for the NJDEP particle size distribution.

The recommended HydroDome HD 4i treats 100 % of the annual runoff and provides 87 % annual TSS removal for the Worcester Wso Ap rainfall records and NJDEP particle size distribution.

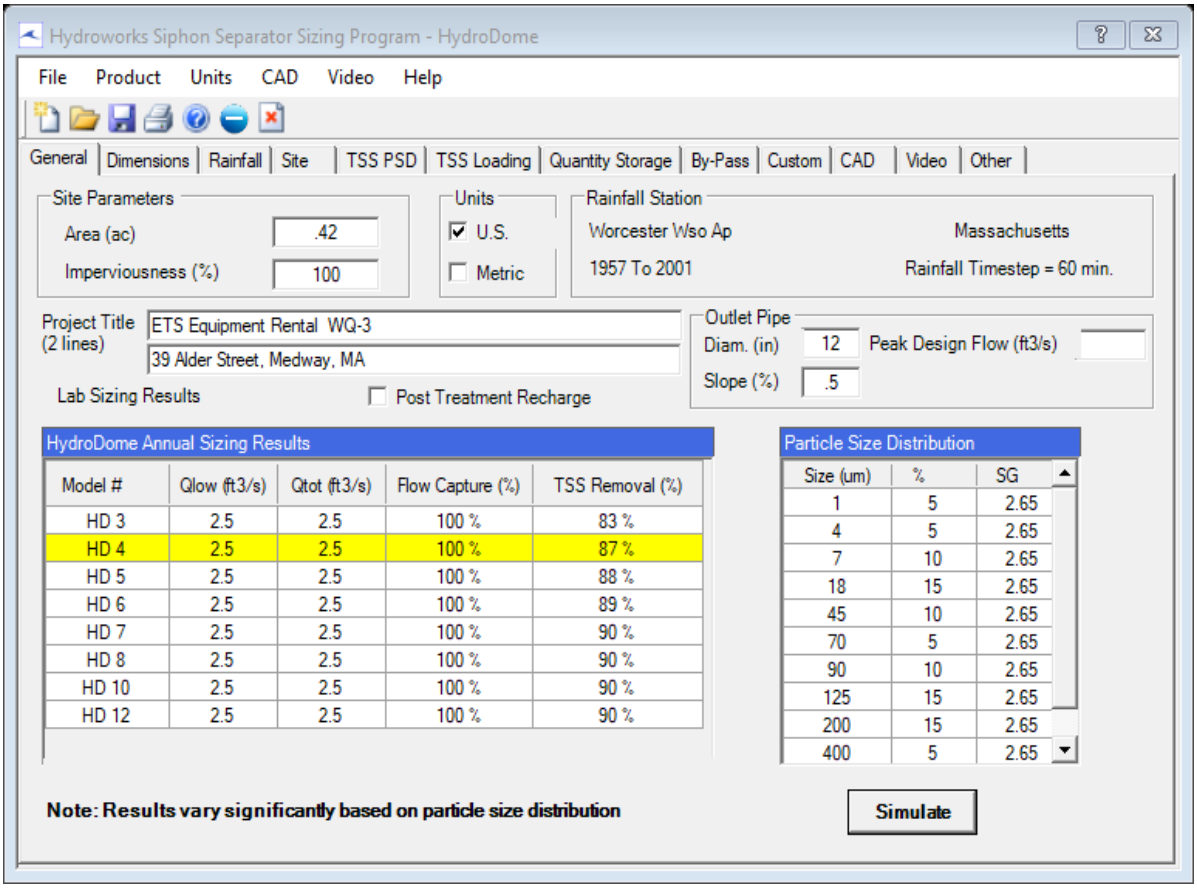
The HydroDome has a siphon which creates a discontinuity in headloss. Since a peak flow was not specified, headloss was calculated using the full pipe flow of 2.52 (ft3/s) for the given 12 (in) pipe diameter at .5% slope. The headloss was calculated to be 11 (in) above the crown of the 12 (in) outlet pipe.

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

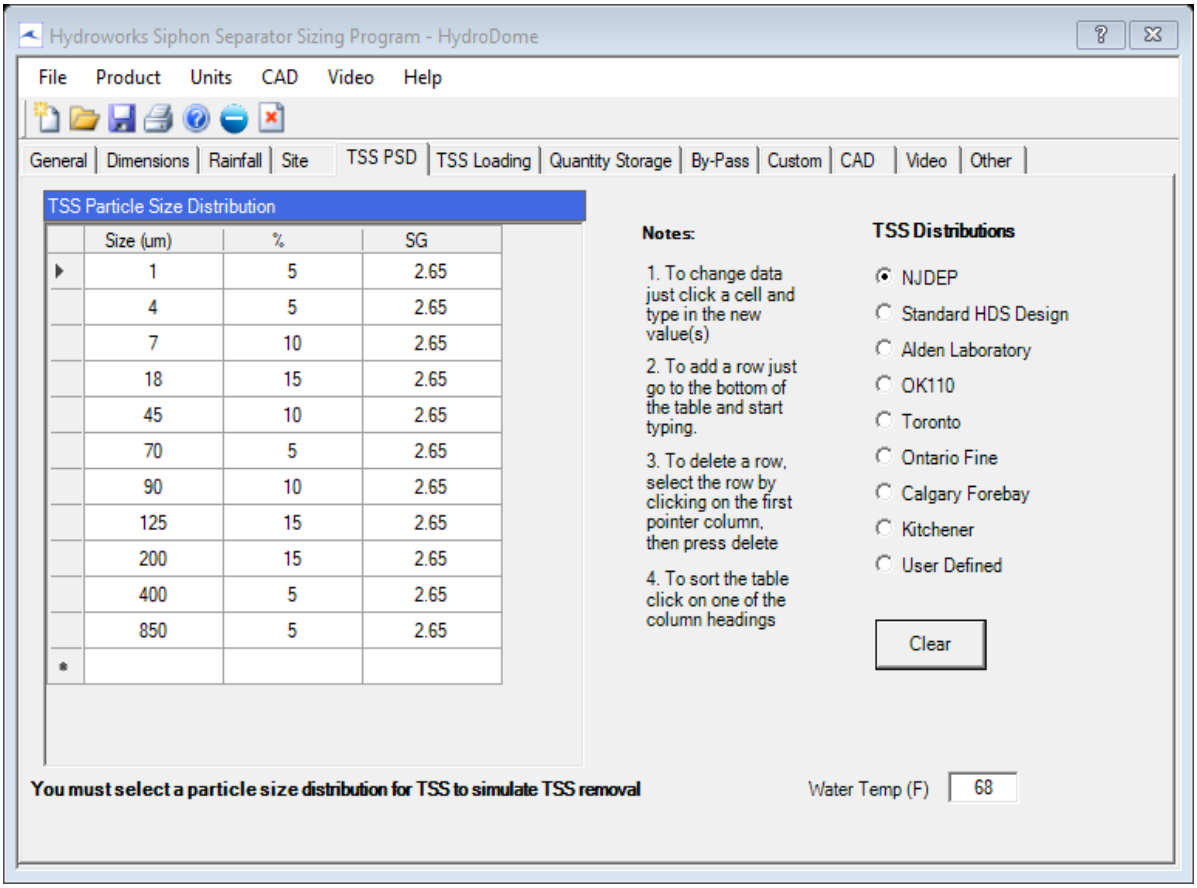
If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroDome .

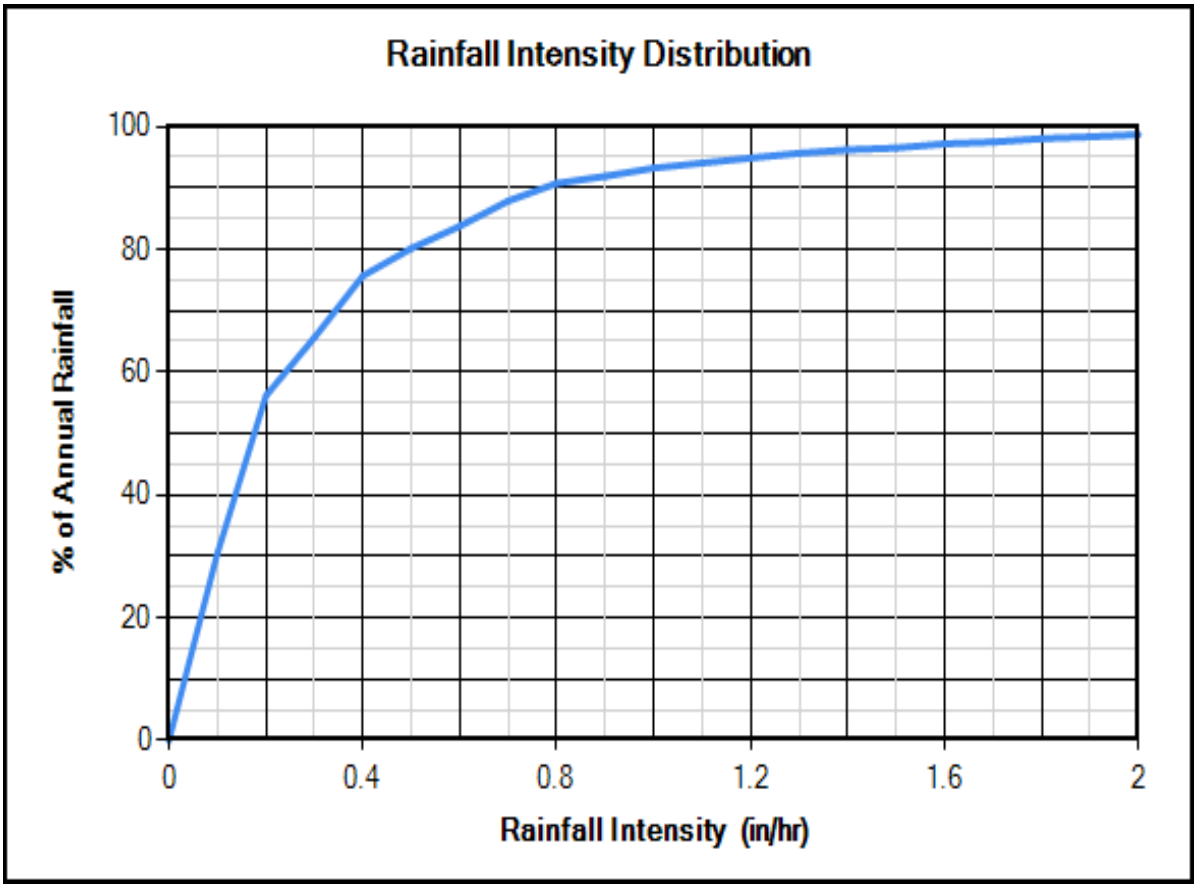
TSS Removal Sizing Summary



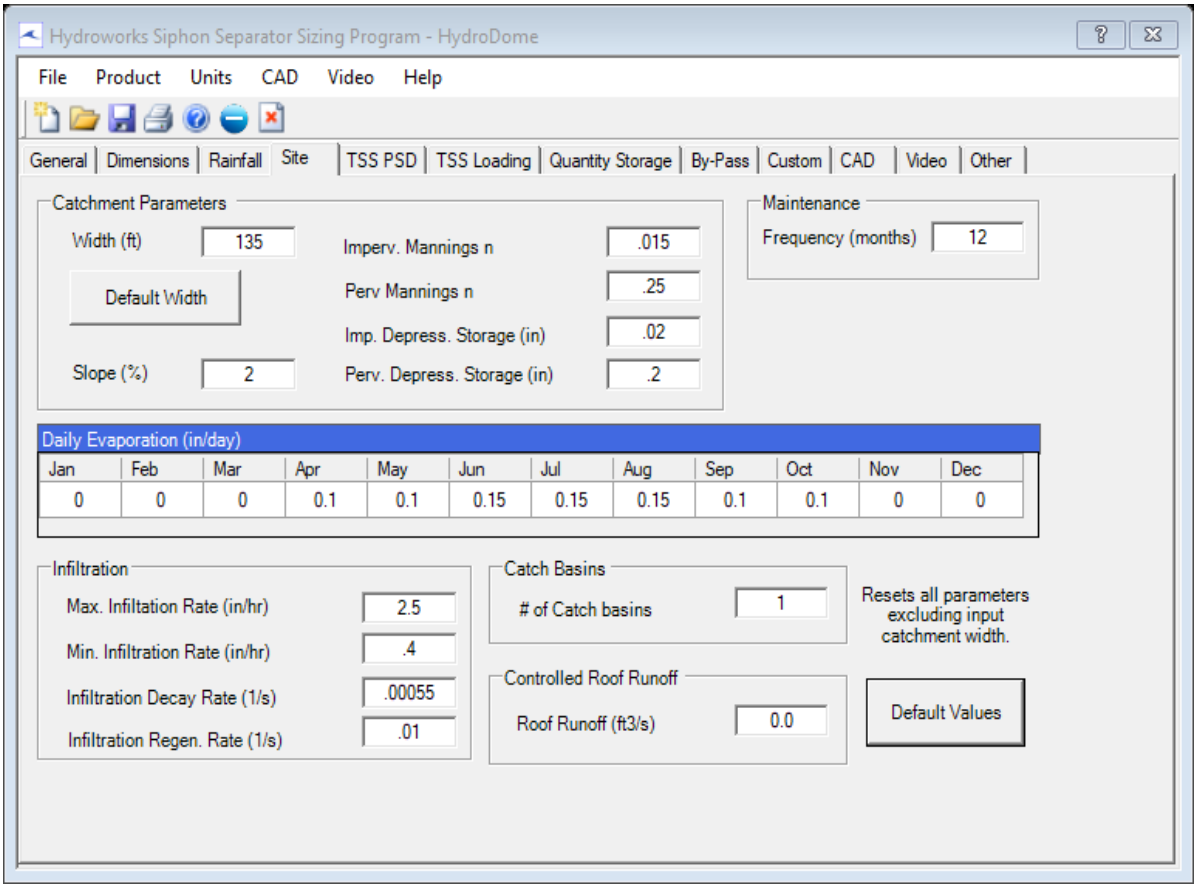
TSS Particle Size Distribution



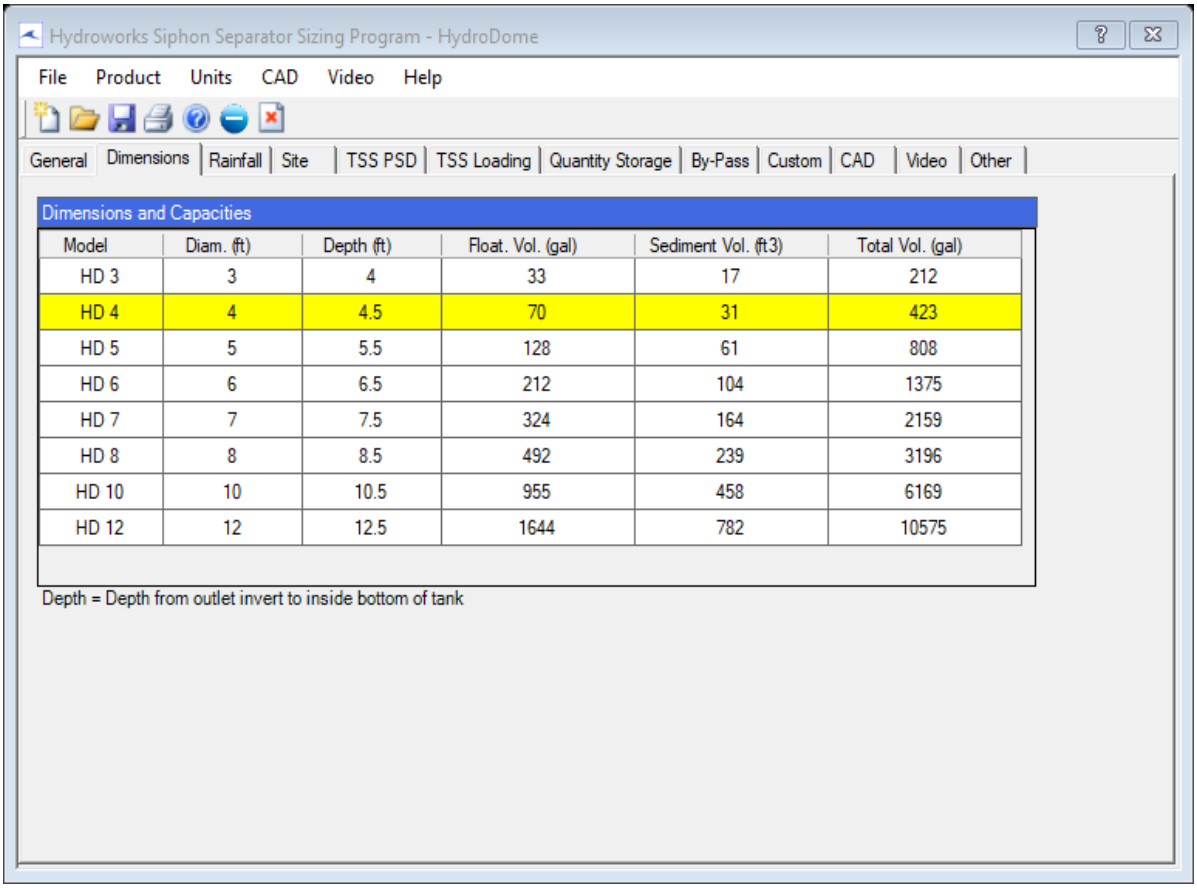
Rainfall Station - Worcester Wso Ap, Massachusetts(1957 To 2001)



Site Physical Characteristics



Dimensions And Capacities



Dimensions and Capacities

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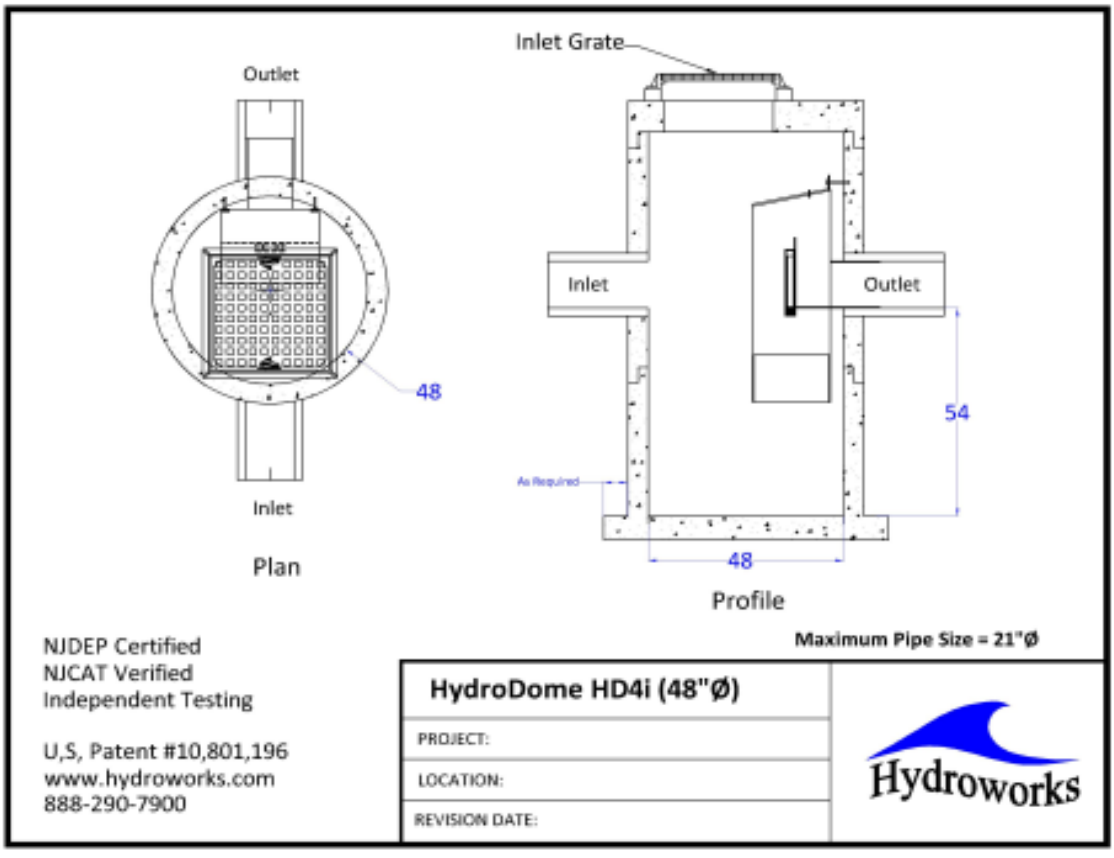
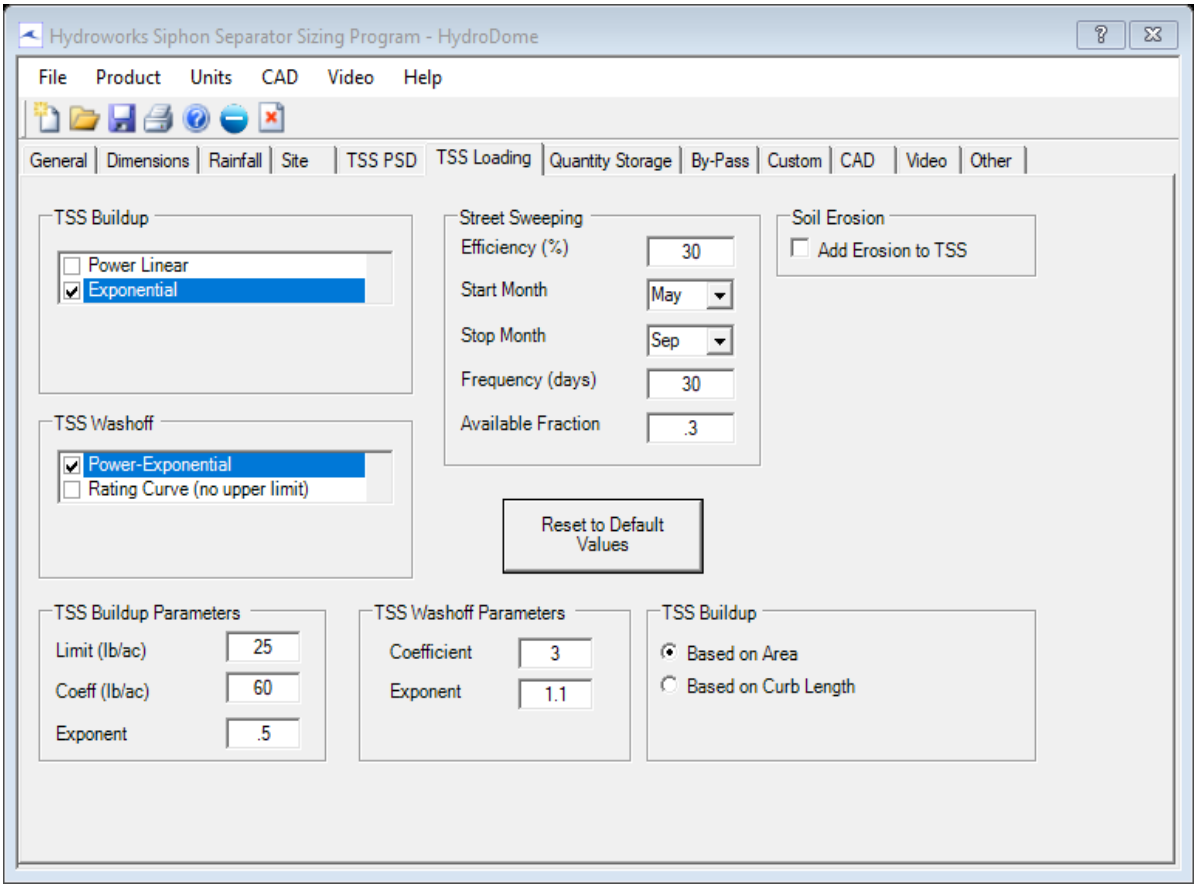
Depth = Depth from outlet invert to inside bottom of tank

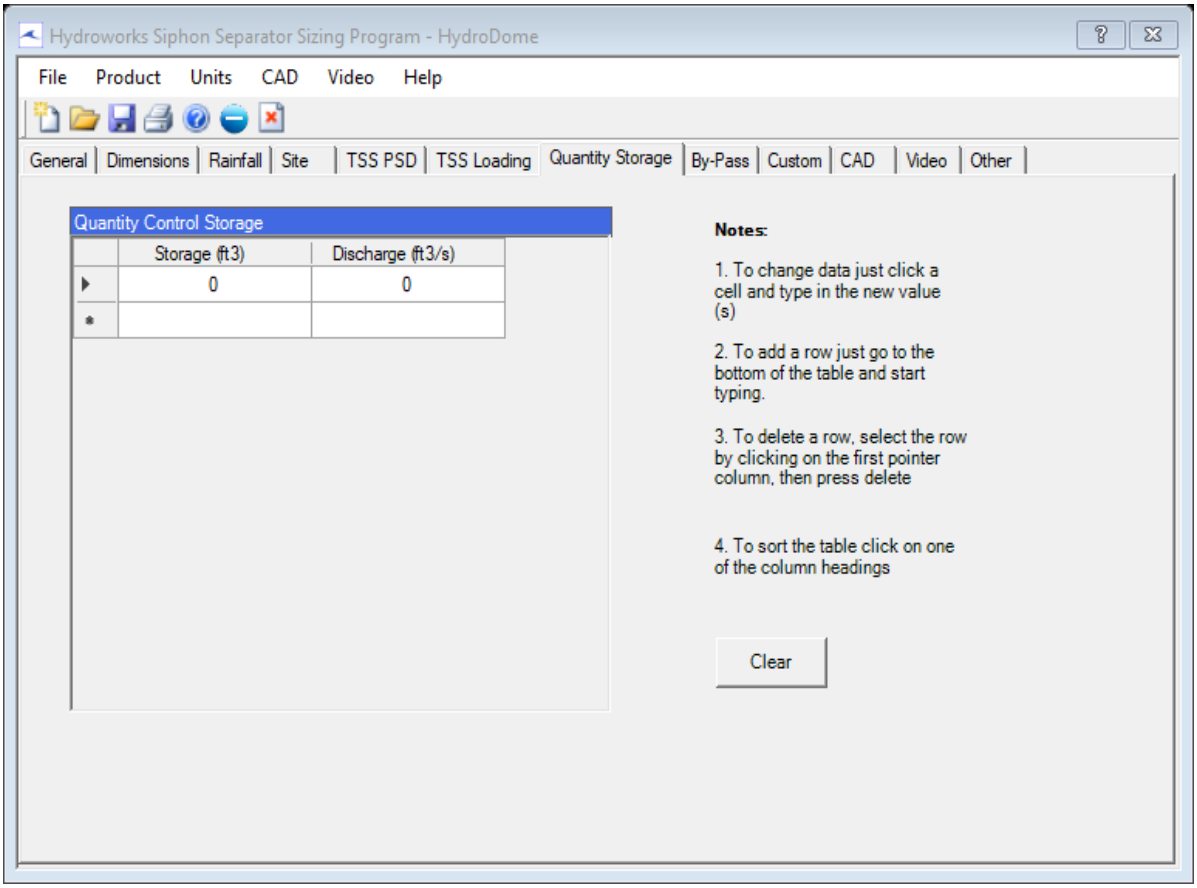
Generic HD 4i CAD Drawing



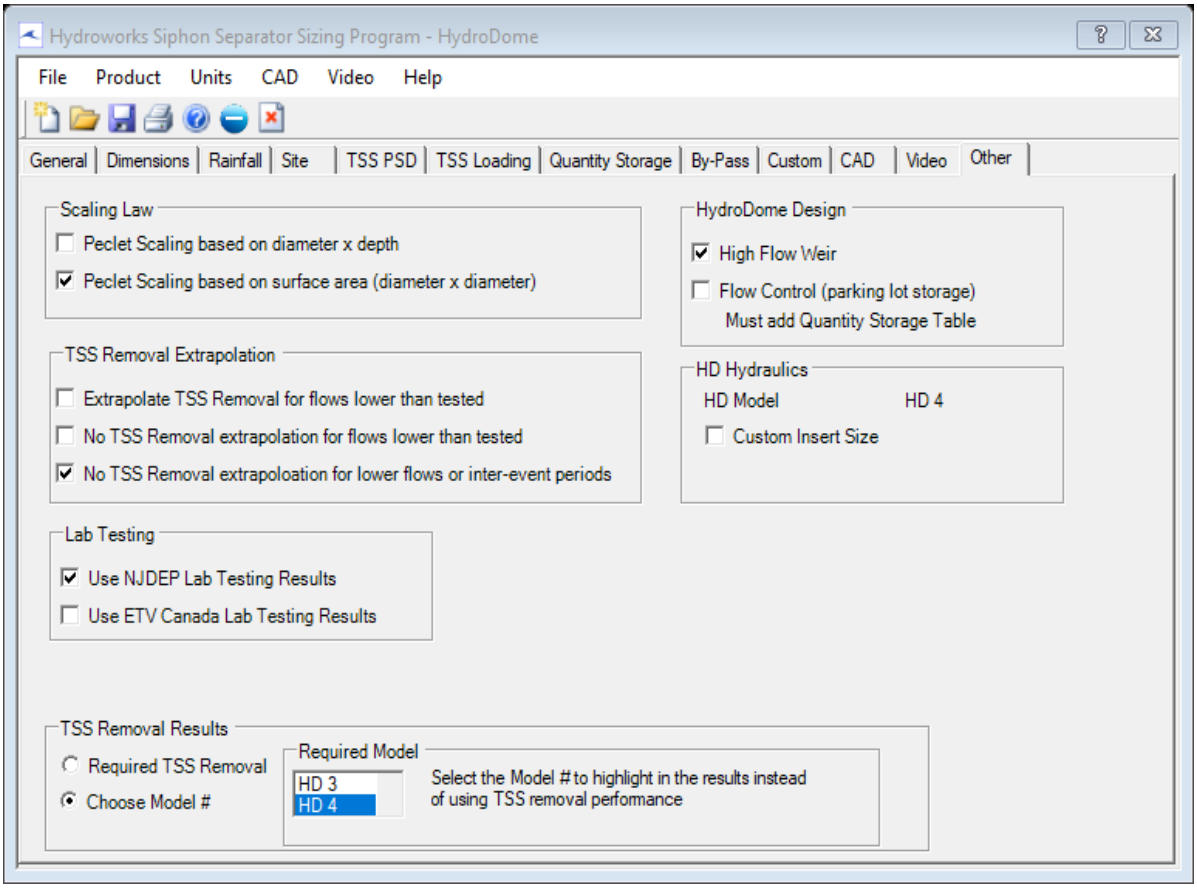
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Flagged Issues

If there is underground detention storage upstream of the HydroDome please contact Hydroworks to ensure it has been modeled correctly.

Hydroworks Sizing Program - Version 5.8

1-800-290-7900
www.hydroworks.com

Appendix H

Stormwater Management System
Long-Term Operation & Maintenance (O&M) Plan

STORM WATER MANAGEMENT SYSTEM
LONG-TERM OPERATION & MAINTENANCE PLAN

Revised February 16, 2024

Proposed Commercial Building
#39 Alder Street
Medway, MA

Prepared For:
ETS Properties, LLC.
11 Airport Road
Hopedale, MA 01747

Prepared By:
CMG Environmental, Inc.
67 Hall Road
Sturbridge, MA 01566
Phone: (774) 241-0901

CMG ID 2020-149

TABLE OF CONTENTS

TABLES

ATTACHMENTS

Long Term Operation & Maintenance Plan
Site Stormwater Management System
#39 Alder Street
Proposed Commercial Building
MEDWAY, MA

Operation and Maintenance (O&M) Plan

The purpose of this Storm Water Management System Operation and Maintenance Plan is to prevent erosion, sedimentation, pollution or other deterioration of the storm water management system and resource areas located on and adjacent to the site property located at **#39 Alder Street in Medway, MA** (the "Site"). The storm water management system shall be maintained properly to assure its continued performance.

Responsible Party:
ETS Properties, LLC.
11 Airport Road
Hopedale, MA 01747
p. (781) 706-8695

Storm water Management System Owner: **(same as above)**

Site subject to Wetlands Protection Act: **YES**

The "Responsible Party" Shall:

- Prepare and submit an **"Operation and Maintenance (O & M) Compliance Statement" (see Attachment #1)** upon completion of site construction activities.
- Implement the routine and non-routine operation, maintenance, and inspection tasks in accordance with the procedures specified in this document to ensure that all storm water management systems function as designed;
- Maintain a log of all operation and maintenance (O & M) activities for the last five (5) years, including inspections, repairs, replacement and disposal (for disposal, the log shall indicate the type of material and disposal location);
- Make this log available to **Town of Medway** official representatives upon request;
- Agree to notify in writing all "future property owners" of the presence of the storm water management system and the requirement for proper operation and maintenance.

"Interstate Towing." maintains a contract with the following companies:

Landscaping & Pavement Maintenance: _____

Snow Removal & Plowing: _____

Storm Water System Maintenance: _____

Table No. 1
#39 Alder Street, Medway, MA
Proposed Commercial Building

STORMWATER SYSTEM INSPECTION AND MAINTENANCE SCHEDULE		
Best Management Practice (BMP)	**Inspection Frequency**	**Maintenance Frequency**
STRUCTURAL BMPs		
DEEP-SUMP HOODED CATCH BASIN	Four (4) Times/ Year At end of foliage & snow removal seasons	Remove Sediment if Sediment Depth Reaches 50% of Sump as Min 2 Times per Year (End of Foliage & Snow Removal Season)
RAIN GARDEN	Monthly	Mulching and Pruning Conducted in Fall and Spring, Remove and Replace Dead Vegetation During the Growing Season, Replace Media and Vegetation as Needed.
HYDRODOME WATER QUALITY UNITS	Four (4) Times / Year	Per Manufacturer's Recommendations (See Attached Hydrostorm Operation and Maintenance Manual)
HYDROFILTER WATER QUALITY UNITS	Within 24 hrs. After Rainfall Event	Per Manufacturer's Recommendations (See Attached Hydrostorm Operation and Maintenance Manual)
UNDERGROUND INFILTRATION CHAMBERS	Bi-Annual (Early Spring & Late Fall)	As needed
8" OUTLET PIPES Rip-Rap Apron	Four (4) Times / Year	Remove Sediment Four (4) Times / Year (Including End of Foliage & Snow Removal Seasons)
NON-STRUCTURAL STORMWATER CONTROLS		
SPILL KIT	Four (4) Times / Year	Replenish Spill Kit as Needed
Landscaping	Four (4) Times / Year	Seasonally As Needed
Roadway / Driveway Sweeping	Two (2) Times /Year	Seasonally As Needed
Snow Removal	Seasonally As Needed	In Accordance with M.G.L. Title XIV. Public Ways and Works; Chapter 85

STRUCTURAL STORMWATER BMP MAINTENANCE:

Deep Sump Catch Basin(s):

- Inspect or clean catch basin(s) at least four (4) times per year, including the end of the foliage and snow removal seasons.
- Inspection shall occur by probing the structure with a rod to determine the depth of accumulated sediment.
- Sediments must be removed whenever the depth of sediment is greater than or equal to one half of the depth from the bottom of the invert of the lowest pipe in the basin. At a minimum, cleaning shall occur twice a year during the spring and fall.
- The structure will be cleaned of water and sand/debris with the use of a vacuum truck. Material removed from the structure will be disposed of legally off-site by the vendor.
- Unless there is evidence that they have been contaminated by a spill or other means, catch basin cleanings may be taken to a landfill or other facility permitted by MassDEP to accept solid waste.

Rain Garden

- Inspect soil and repair eroded areas monthly. Re-mulch void areas as needed.
- Litter and debris shall be removed from the garden on a monthly basis.
- Remove and replace dead vegetation twice per year (spring & fall).
- Remove invasive species as needed to prevent these species as needed to prevent species from spreading into the bioretention area. Replace mulch every two years, in the early spring. Upon failure, excavate bioretention area, scarify bottom and sides, replace filter fabric and soil, replant, and mulch.

Hydrodome Water Quality Units (HD-4)

- Per manufacturer's recommendations, see Attachment #2: Hydroworks Hydrodome Operation and Maintenance Manual
- Due to potential oil exposure from paved parking/ storage areas, the HydroDome separators shall be inspected 4 times per year
- Separator is typically maintained using a vacuum truck. If a vacuum truck is not available, a clamshell bucket may be used instead.
- During construction, the unit must be cleaned when; sediment reaches 24", there is an appreciable amount of oil (more than a sheen), or if floatables other than oil cover over 50% of the area of the separator.
- During Post-Construction, the unit must be cleaned once depth of sediment reaches 1 ft.

Hydrofilter Water Quality Units

- Per manufacturer's recommendations, see Attachment #2: Hydroworks Hydrofilter Operation and Maintenance Manual

- The Hydrofilter should be inspected 24 hours after rainfall. If the structure has not drained down to the outlet pipe within 24 hours of the last rainfall, the unit requires maintenance.
- Filter cartridges shall not be constructed during construction. A plate is installed at the base of the unit during construction and is removed when the cartridges are installed for post-development operation.
- Unit should be inspected twice during the first year of operation once site is stabilized.
- Maintenance involves removing the water and replacing the filter cartridges. All water shall be removed from system prior to filter replacement. Filter cartridges can be removed from sleeve via a hook.
- Filter cartridge for small units may be replenished to extend the frequency of replacement.

Underground Infiltration Chambers

- Inspect inlet at least twice a year and remove any debris that may clog the system.

Rip-rap Apron Outlets

- Inspect regularly, especially after large rainfall events;
- Note and repair any erosion & sediment buildup at the Rip-Rap outlet protection.

NON- STRUCTURAL STORM WATER MANAGEMENT CONTROLS:

Non-Structural Control Measures & Stormwater Treatment

Vehicle Maintenance Areas:

- No outdoor vehicle maintenance is proposed for this application. Any light fleet maintenance or vehicle washing will be done indoors. Please note, floor drains connected to an oil-grit separator is proposed to handle vehicle wash water prior to being discharged into the municipal sanitary sewer system.

- **SPILL KIT** - a minimum of one (1) 55-gallon overpack drum, spill response equipment, and oil absorbents need to be located on-site in an accessible location within the building.

Landscape & Pavement Maintenance:

- **No debris, refuse or other materials,** including but not limited to landscaping debris, leaves, shrubs and tree trimmings, logs, bricks, stone or trash shall be deposited within the vegetated wetland.

- The use of pesticides, herbicides, and fertilizers on the site shall be minimized to the extent practicable and shall be applied in accordance with manufacture recommendations by experienced and if applicable, licensed personnel.

- Only allowed slow-release organic in jurisdictional areas such as within 100’ from wetland resources.

- Pavement areas will be swept seasonally as necessary to remove accumulated winter sand and salt and fall leaves, and shall be swept as required to remove litter. Collected material will be properly disposed of off-site.

- Storage of fertilizer, pesticides, & herbicides is prohibited within the jurisdictional areas.

- Storage of materials, such as salt or building materials, shall be stored indoors or undercover if located outside.

Trash Removal

- Inspect on-site area for litter and trash as needed. Any accumulated trash, litter, and discarded materials in this area will be removed and will be disposed of at a suitable location on a weekly basis. Solid waste will be collected in the proposed dumpster and discarded from the site via the trash removal contractor.

Materials & Waste Storage

- Non-hazardous materials are to be stored within the limits of the secured/ fenced-in "storage yard" as shown on the enclosed Site Plans. Non-hazardous waste will be discarded in the proposed dumpster (location shown on site plans). Any combustibles are to be stored inside the proposed building in fire rated cabinets. No other hazardous materials or waste is to be stored on premise.

HAZARDOUS WASTE / OIL SPILL RESPONSE PROCEDURE

Initial Notification. In the event of a spill of hazardous waste or oil the facility manager or supervisor will be notified immediately by telephone.

Assessment – Initial Containment. The supervisor or manager will assess the incident and initiate control measures. The supervisor will first contact the **Town of Medway Fire Department** and then notify the **Town of Medway Police Department**. The Fire Department is ultimately responsible for matters of public health and safety and should be notified immediately.

Fire Department Telephone: 911 (Emergency); (508) 533-3213 (Non-Emergency)

Police Department Telephone: 911 (Emergency); (508) 533-3212 (Non-Emergency)

Further Notification. Based on the assessment by the Fire Chief, additional notification to a clean up contractor may be made. The Massachusetts Department of Environmental Protection and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of clean up and notification required.

SNOW MANAGEMENT PLAN:

- No snow storage shall be located within or "deposited" within wetland resource areas on or off-site.
- No salt shall be used to treat unpaved areas during snow and ice conditions. The storage of all "de-icing" chemicals and treatment products is to be inside the building.
- If Site snow storage interferes with driveway maneuvers or sight distances (i.e., blocking of travel aisles, sight distance, or parking) the snow pile will be either removed or reduced legally in a legal manner by the snow plow vendor within 24-hours.
- Pavement areas will be swept seasonally as necessary to remove accumulated winter sand and salt and fall leaves, and shall be swept as required to remove litter. Collected material will be properly disposed of off-site.

INSPECTIONS / RECORDKEEPING:

Routine Inspections:
Routine inspections and maintenance to be conducted with the frequency described in this Operation and Maintenance Plan. All repairs and maintenance activities regarding the stormwater management system should be recorded and provided to the Medway Planning Board upon request. An example inspection form is provided in **Attachment #2**.

Recordkeeping
Records of all drainage system inspections and maintenance shall be kept on file for a period of at least **five (5) years.**

PUBLIC SAFETY FEATURES:

- All cast iron storm water structure grates and covers shall be kept in good condition and kept closed at all times. Any damaged or broken structures will be replaced immediately upon discovery;

STAFF TRAINING:

- Staff training shall be conducted on an annual basis regarding the long-term operation and maintenance of the proposed stormwater management system. A training log is recommended for each annual training and kept for recording purposes for a minimum of three (3) years.

Attachment #1

Illicit Discharge Compliance Statement

Illicit Discharge Compliance Statement
Site Storm Water Management System
#39 Alder Street
Proposed Commercial Building
MEDWAY, MA

Responsible Party:
ETS Properties, LLC.
11 Airport Road
Hopedale, MA 01747
p. (781) 706-8695

Storm Water Management System Owner: (same as above)

Site subject to Wetlands Protection Act: YES

The above listed "responsible party" is responsible for implementation of this "Long-Term Operation and Maintenance Plan" and certifies that:

- The site has been inspected for erosion and appropriate steps have been taken to permanently stabilize any eroded areas;
- All aspects of storm water BMPs have been inspected for damage, wear and malfunction, and appropriate steps have been taken to repair or replace the system or portions of the system so that the storm water at the site may be managed in accordance with:
    - MA-DEP Stormwater Management Standards, revise date January 2, 2008;
- There is no record or knowledge of illicit discharges to the on-site stormwater management system;
- All "future property owners" must be notified of their continuing legal responsibility to operate and maintain the Site Stormwater Management System.
- The "Long-Term Operation and Maintenance Plan" for the storm water BMPs is being implemented.

Signature of Responsible Party:

_____ _____
ETS Properties, LLC. Date

Attachment #2

Hydroworks
Operations & Maintenance Manuals

Hydroworks® HydroDome

Operations & Maintenance Manual

Version 1.0

Please call Hydroworks at 888-290-7900 or email us at support@hydroworks.com if you have any questions regarding the Inspection Checklist. Please email a copy of the completed checklist to Hydroworks at support@hydroworks.com for our records.

Introduction

The HydroDome (Figure 1) is a state-of-the-art hydrodynamic separator. HydroDome can be used for water quality and quantity flow control if desired.

Hydrodynamic separators remove solids, debris and lighter than water (oil, trash, floating debris) pollutants from stormwater. Hydrodynamic separators and other water quality measures are mandated by regulatory agencies (Town/City, State, Federal Government) to protect storm water quality from pollution generated by urban development (traffic, people) as part of new development permitting requirements.

As storm water treatment structures fill up with pollutants they become less and less effective in removing new pollution. Therefore, it is important that storm water treatment structures be maintained on a regular basis to ensure that they are operating at optimum performance. The HydroDome is no different in this regard and this manual has been assembled to provide the owner/operator with the necessary information to inspect and coordinate maintenance of their HydroDome.

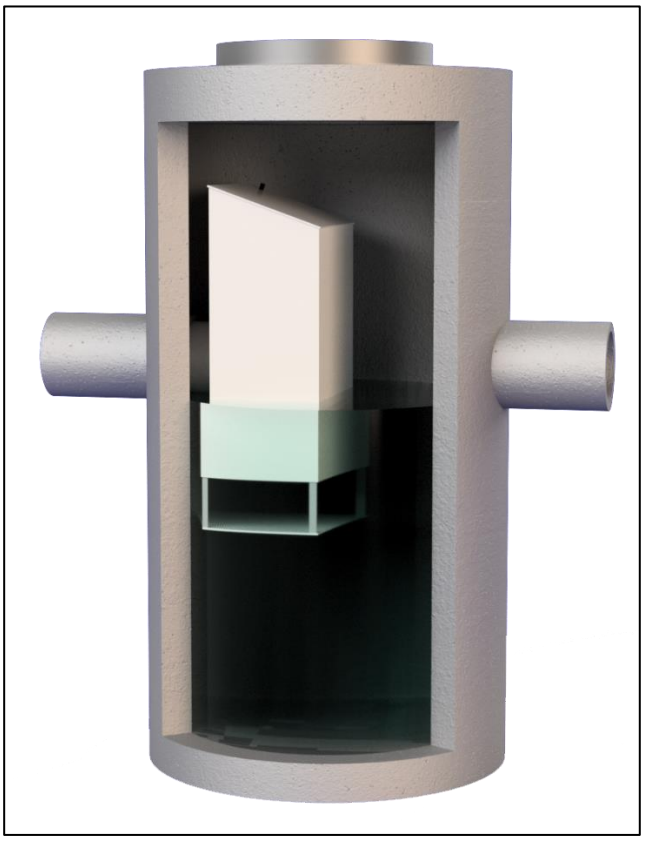


Figure 1. Hydroworks HydroDome

Hydroworks

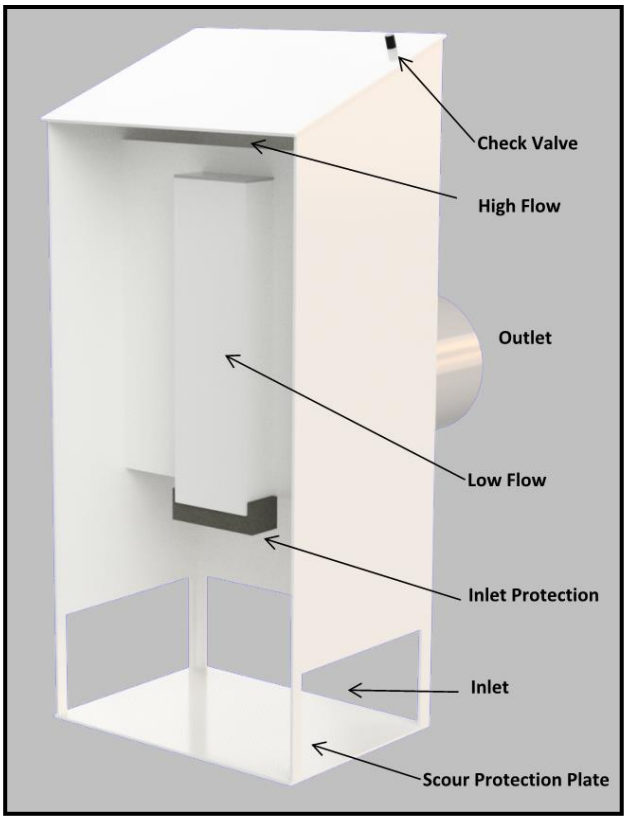


Figure 2 HydroDome Internal Components

Inspection

Procedure

Floatables

A visual inspection can be conducted for floatables by removing the cover/grate and looking down into the separator.

TSS/Sediment

Inspection for TSS build-up can be conducted using a Sludge Judge®, Core Pro®, AccuSludge® or equivalent sampling device that allows the measurement of the depth of TSS/sediment in the unit. These devices typically have a ball valve at the bottom of the tube that allows water and TSS to flow into the tube when lowering the tube into the unit. Once the unit touches the bottom of the device, it is quickly pulled upward such that the water and TSS in the tube forces the ball valve closed allowing the user to see a full core of water/TSS in the unit. Several readings (2 or 3) should be made at different locations of the structure to ensure that an accurate TSS depth measurement is recorded.

Operation

The water level during periods without rain should be near the outlet invert of the structure. If the water level remains near the top of the HydroDome this may suggest that there is an obstruction downstream of the HydroDome or that the inlet protection at the HydroDome may need to be cleaned.

Frequency

Construction Period

The HydroDome separator should be inspected every four weeks and after every large storm (over 0.5" (12.5 mm) of rain) during the construction period.

Post-Construction Period

The Hydroworks HydroDome separator should be inspected during the first year of operation for normal stabilized sites (grassed or paved areas). If the unit is subject to oil spills or runoff from unstabilized areas (storage piles, exposed soils), the HydroDome separator should be inspected more frequently (4 times per year). The initial annual inspection will indicate the required frequency of inspection and maintenance if the unit was maintained after the construction period.

Reporting

Reports should be prepared as part of each inspection and include the following information:

1. Date of inspection
2. GPS coordinates of Hydroworks unit
3. Time since last rainfall
4. Date of last inspection
5. Installation deficiencies (missing parts, incorrect installation of parts)
6. Structural deficiencies (concrete cracks, broken parts)
7. Operational deficiencies (leaks, elevated water level)
8. Presence of oil sheen or depth of oil layer
9. Estimate of depth/volume of floatables (trash, leaves) captured
10. Sediment depth measured
11. Recommendations for any repairs and/or maintenance for the unit
12. Estimation of time before maintenance is required if not required at time of inspection

A sample inspection checklist is provided at the end of this manual.

Maintenance

Procedure

The Hydroworks HydroDome unit is typically maintained using a vacuum truck. There are numerous companies that can maintain the HydroDome separator. Maintenance with a vacuum truck involves removing all of the water and sediment together. The water is then separated from the sediment on the truck or at the disposal facility.

The area around the HydroDome provides clear access to the bottom of the structure (Figure 3). This is the area where a vacuum hose would be lowered to clean the unit.

In instances where a vacuum truck is not available other maintenance methods (i.e. clamshell bucket) can be used, but they will be less effective. If a clamshell bucket is used the water must be decanted prior to cleaning since the sediment is under water and typically fine in nature.

The local municipality should be consulted for the allowable disposal options for both water and sediments prior to any maintenance operation. Once the water is decanted the sediment can be removed with the clamshell bucket.

Maintenance of a Hydroworks HydroDome unit will typically take 1 to 2 hours depending on size of unit and using a vacuum truck. Cleaning may take longer for other cleaning methods (i.e. clamshell bucket).

Inlet protection (Figure 2) in the form of a coarse foam screen is located at the inlet to the siphon opening in the HydroDome to ensure the opening does not become clogged. Although it is not anticipated that the inlet protection will have to be replaced on a regular basis since the inlet protection is protected by the submerged entrance to the HydroDome and is backflushed by the siphon after each storm , the inlet protection should be checked each time the HydroDome is inspected or maintained. The inlet protection is removable and should be rinsed with water to ensure any debris caught on the protection is discarded. Unless damaged, the inlet protection can be reinstalled. A replacement piece can be bought through Hydroworks and/or retail stores. Hydroworks can provide information on the inlet protection and where it can be bought. A sign that the inlet protection needs cleaning/replacement would be a water level near the crown of the outlet pipe in the structure during periods with no flow (i.e. unit does not drain down to the pipe invert).

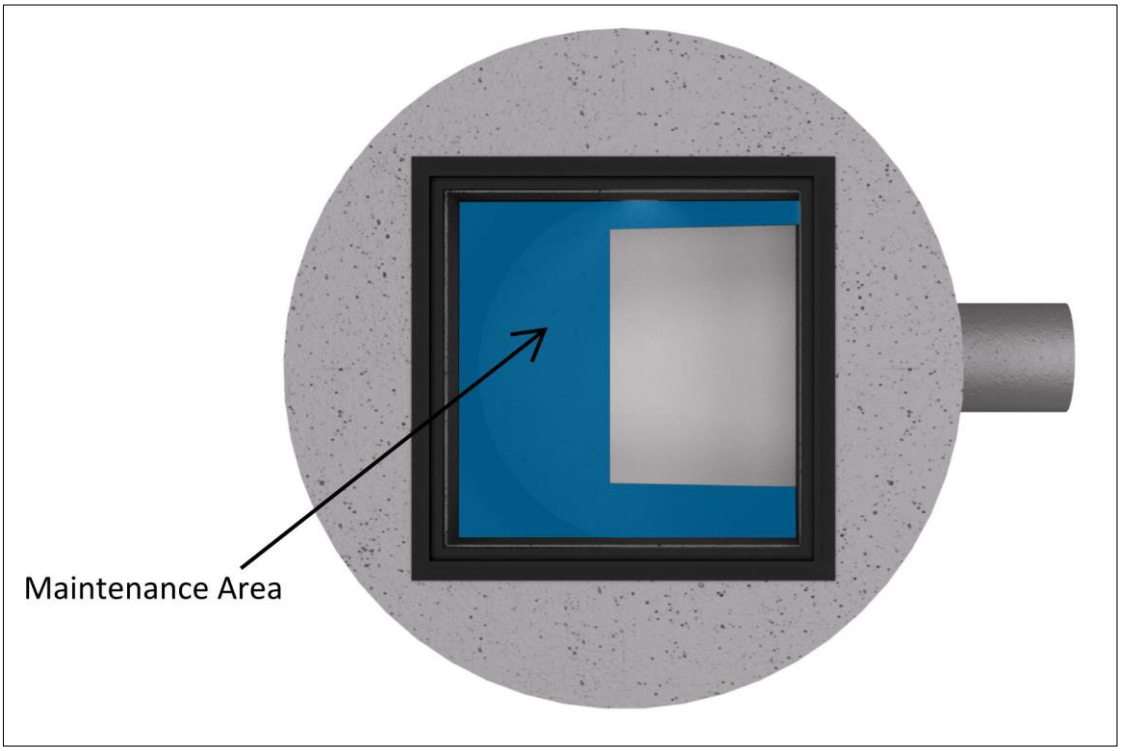


Figure 3. HydroDome Maintenance Access

Frequency

Construction Period

A HydroDome separator can fill with construction sediment quickly during the construction period. The HydroDome must be maintained during the construction period when the depth of TSS/sediment reaches 24” (600 mm). It must also be maintained during the construction period if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the area of the separator

The HydroDome separator should be maintained at the end of the construction period, prior to operation for the post-construction period.

Post-Construction Period

The maintenance for sediment accumulation is required if the depth of sediment is 1 ft or greater in separators with standard water (sump) depths (Table 1).

There will be designs with increased sediment storage based on specifications or site-specific criteria. Please contact Hydroworks at 888-290-7900 to inquire whether your HydroDome was designed with extra sump depth to extend the frequency of maintenance.

The HydroDome separator must also be maintained if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 75% of the water surface of the separator.

Table 1 Standard Dimensions for Hydroworks HydroDome Models

Model	Diameter ft (mm)	Maintenance Sediment Depth in (mm)
HD 3	3 (900)	12 (300)
HD 4	4 (1200)	12 (300)
HD 5	5 (1500)	12 (300)
HD 6	6 (1800)	12 (300)
HD 7	7 (2100)	12 (300)
HD 8	8 (2400)	12 (300)
HD 10	10 (3000)	12 (300)
HD 12	12 (3600)	12 (300)

HYDRODOME INSPECTION SHEET

Date _____
Date of Last Inspection _____

Site _____
City _____
State _____
Owner _____

GPS Coordinates _____

Date of last rainfall _____

Site Characteristics	**Yes**	**No**
Soil erosion evident	☐	☐
Exposed material storage on site	☐	☐
Large exposure to leaf litter (lots of trees)	☐	☐
High traffic (vehicle) area	☐	☐

HydroDome	**Yes**	**No**
Obstructions in the inlet	☐ *	☐
Damage to HydroDome (cracked, broken, loose pieces)	☐ **	☐
Improperly installed outlet pipe	☐ ***	☐
Internal component damage (cracked, broken, loose pieces)	☐ **	☐
Floating debris in the separator (oil, leaves, trash)	☐	☐
Large debris visible in the separator	☐ *	☐
Concrete cracks/deficiencies	☐ ***	☐
Exposed rebar	☐ **	☐
Raised water level (water level close to top of HydroDome)	☐ ***	☐
Water seepage (water level not at outlet pipe invert)	☐ ***	☐

Water level depth below outlet pipe invert _____“

Routine Measurements

Floating debris depth	**< 0.5” (13mm)**	☐	**>0.5” 13mm)**	☐ *
Floating debris coverage	**< 75% of surface area**	☐	**> 75% surface area**	☐ *
Sludge depth	**< 12” (300mm)**	☐	**> 12” (300mm)**	☐ *****

* Maintenance required
** Repairs required
*** Further investigation is required

Note: Inspections should not be made within 24 hours of a storm to allow the water to drain from the structure to assess a raised water level or water level seepage

Hydroworks

Other Comments:

Hydroworks

Hydroworks® HydroDome

One Year Limited Warranty

Hydroworks, LLC warrants, to the purchaser and subsequent owner(s) during the warranty period subject to the terms and conditions hereof, the Hydroworks HydroDome to be free from defects in material and workmanship under normal use and service, when properly installed, used, inspected and maintained in accordance with Hydroworks written instructions, for the period of the warranty. The standard warranty period is 1 year.

The warranty period begins once the separator has been manufactured and is available for delivery. Any components determined to be defective, either by failure or by inspection, in material and workmanship will be repaired, replaced or remanufactured at Hydroworks' option provided, however, that by doing so Hydroworks, LLC will not be obligated to replace an entire insert or concrete section, or the complete unit. This warranty does not cover shipping charges, damages, labor, any costs incurred to obtain access to the unit, any costs to repair/replace any surface treatment/cover after repair/replacement, or other charges that may occur due to product failure, repair or replacement.

This warranty does not apply to any material that has been disassembled or modified without prior approval of Hydroworks, LLC, that has been subjected to misuse, misapplication, neglect, alteration, accident or act of God, or that has not been installed, inspected, operated or maintained in accordance with Hydroworks, LLC instructions and is in lieu of all other warranties expressed or implied. Hydroworks, LLC does not authorize any representative or other person to expand or otherwise modify this limited warranty.

The owner shall provide Hydroworks, LLC with written notice of any alleged defect in material or workmanship including a detailed description of the alleged defect upon discovery of the defect. Hydroworks, LLC should be contacted at 136 Central Ave., Clark, NJ 07066 or any other address as supplied by Hydroworks, LLC. (888-290-7900).

This limited warranty is exclusive. There are no other warranties, express or implied, or merchantability or fitness for a particular purpose and none shall be created whether under the uniform commercial code, custom or usage in the industry or the course of dealings between the parties. Hydroworks, LLC will replace any goods that are defective under this warranty as the sole and exclusive remedy for breach of this warranty.

Subject to the foregoing, all conditions, warranties, terms, undertakings or liabilities (including liability as to negligence), expressed or implied, and howsoever arising, as to the condition, suitability, fitness, safety, or title to the Hydroworks HydroDome are hereby negated and excluded and Hydroworks, LLC gives and makes no such representation, warranty or undertaking except as expressly set forth herein. Under no circumstances shall Hydroworks, LLC be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the HydroDome, or the cost of other goods or services related to the purchase and installation of the HydroDome. For this Limited Warranty to apply, the HydroDome must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and Hydroworks' written installation instructions.

Hydroworks, LLC expressly disclaims liability for special, consequential or incidental damages (even if it has been advised of the possibility of the same) or breach of expressed or implied warranty. Hydroworks, LLC shall not be liable for penalties or liquidated damages, including loss of production and profits; labor and materials; overhead costs; or other loss or expense incurred by the purchaser or any third party. Specifically excluded from limited warranty coverage are damages to the HydroDome arising from ordinary wear and tear; alteration, accident, misuse, abuse or neglect; improper maintenance, failure of the product due to improper installation of the concrete sections or improper sizing; or any other event not caused by Hydroworks, LLC. This limited warranty represents Hydroworks' sole liability to the purchaser for claims related to the HydroDome, whether the claim is based upon contract, tort, or other legal basis.

Hydroworks® HydroFilter

Operations & Maintenance Manual

Standard Filter

Version 1.0

Introduction

The HydroFilter is a stormwater management device designed to both treat stormwater.

As storm water treatment structures fill up with pollutants they become less and less effective in removing new pollution. This is especially true of any stormwater treatment practice that includes filtration such as HydroFilter. Therefore, it is important that storm water treatment structures be maintained on a regular basis to ensure that they are operating at optimum performance. The HydroFilter is no different in this regard and this manual has been assembled to provide the owner/operator with the necessary information to inspect and coordinate maintenance of their HydroFilter.

Hydroworks® HydroFilter Operation

Hydroworks HF Operation

Under normal or low flows, water enters the structure through a grate or inlet pipe . Incoming water builds up around the filters and creates head to drive water radially into the filter cartridges from the outside through to the center of the cartridge. There is a 6" (150mm) diameter open center that runs through the center of each cartridge. Water reaching the center flows down into the base plug and is conveyed out of the structure by a pipe that conveys the treated flow behind a weir wall. The height of the weir wall provides the necessary head to push the inlet water through the filter and depends on the difference in elevation between the inlet and outlet pipe(s) (Figure 1).

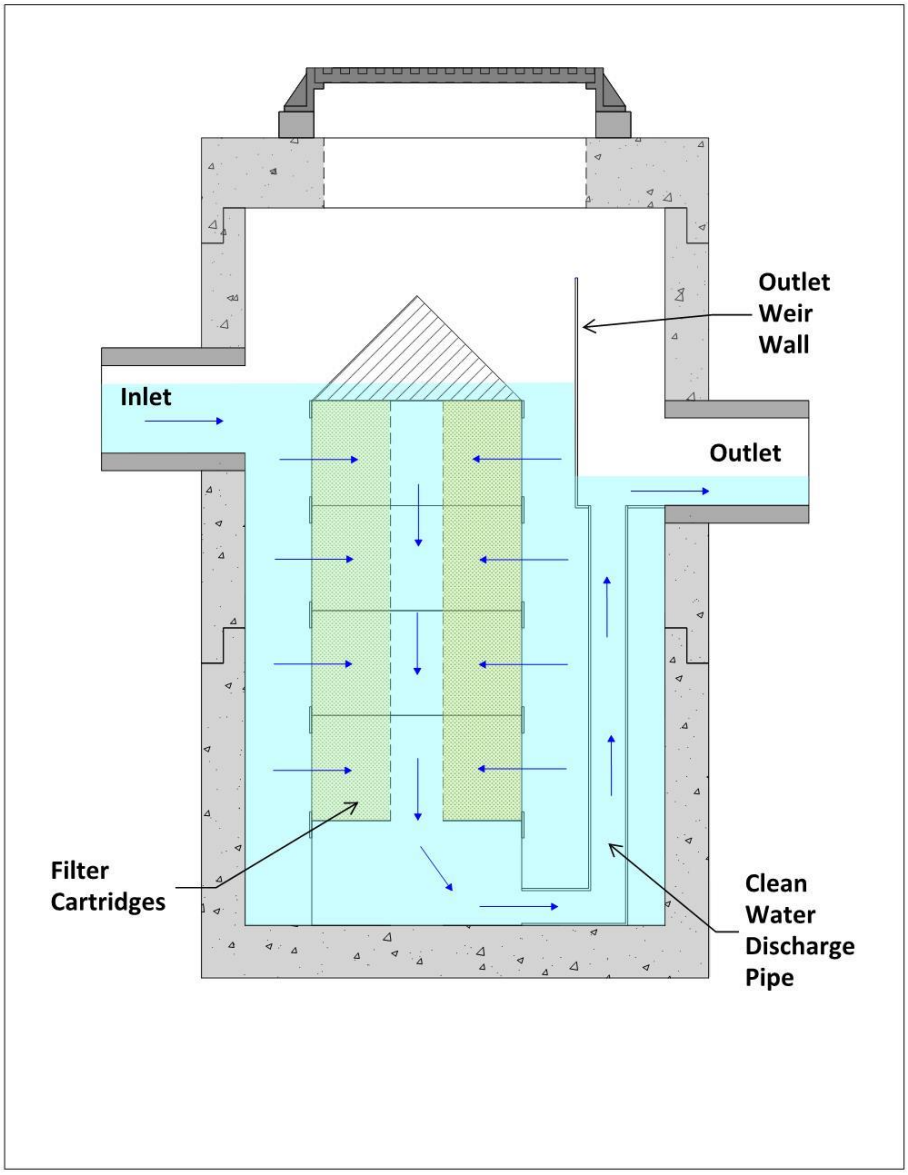


Figure 1. Hydroworks HydroFilter Operation – Standard Filter

A solid cone with a check valve is placed on top of the top filter cartridge to prevent incoming water from entering the 6" (150 mm) diameter opening while still allowing air to escape from the center of the cartridges as water enters the filter.

High flows are typically bypassed around the HydroFilter.

Inspection

Procedure

The HydroFilter should be inspected 24 hours after rainfall.

If the structure has not drained down to the outlet pipe within 24 hours of the last rainfall, the HydroFilter requires maintenance (i.e. water level on either side of the weir wall is the same).

Frequency

Construction Period

The filter cartridges **should not** be installed in the HydroFilter during the construction period since construction sediment will prematurely plug the cartridges requiring excessive maintenance during the construction period. A plate is installed in the base for the construction period to remind the contractor that the cartridges should only be installed for post construction operation. This plate needs to be removed when the cartridges are installed for post development operation.

If the HydroFilter is installed in an offline configuration, the cartridges in the HydroFilter can be installed prior to delivery of the structure during the construction period, however, the inlet and outlet from the HydroFilter structure must be plugged such that any sediment-laden water bypasses the HydroFilter. These plugs then have to be removed after the construction period to allow post construction operation of the HydroFilter.

Post-Construction Period

The Hydroworks HydroFilter should be inspected twice during the first year of operation for normal stabilized sites (no exposed soil or materials storage). The initial inspections will indicate the required future frequency of inspection and maintenance if the unit was maintained and put into service (filters installed) after the construction period.

It is anticipated that the filter cartridges will need to be replaced annually. However, this will depend on pollutant loadings on the site and off-site activities (nearby construction, etc.). Filters are different from separators in that sediment levels at the bottom of a filter do not dictate maintenance frequency.

A filter does not need to be maintained until its' rated treatment rate decreases to the point where it can no longer provide the required annual percentage of pollutant removal. This is a hydraulic requirement that will depend on the hydrology (rainfall intensity distribution) and characteristics of the site (imperviousness, area, pollutant loading) being designed. That is why the frequency of cleaning is based on the

presence of water after a storm since the flow rate is reduced indicating maintenance is required.

Reporting

Reports should be prepared as part of each inspection and include the following information:

1. Date of inspection
2. GPS coordinates of Hydroworks unit
3. Time since last rainfall
4. Date of last inspection
5. Installation deficiencies (missing parts, incorrect installation of parts)
6. Structural deficiencies (concrete cracks, broken parts)
7. Operational deficiencies (leaks, blockages)
8. Presence of oil sheen or depth of oil layer
9. Estimate of depth/volume of floatables (trash, leaves) captured
10. Sediment depth measured
11. Recommendations for any repairs and/or maintenance for the unit
12. Estimation of time before maintenance is required if not required at time of inspection

A sample inspection checklist is provided at the end of this manual.

Maintenance

Procedure

1. Water/Sediment Removal

Maintenance involves removing the water and replacing the filter cartridges. In both cases, sediment that has been collected around the filter cartridges in the sump of the device must be removed first. This is typically done by vacuum truck.

It is important to remove all sediment and water from the structure before trying to remove and replace the filter cartridges.

2. Filter Cartridge Replacement

Replacement of filter cartridges is made easy due to the modular nature of each cartridge. The cartridges are stacked vertically on top of each other. Each cartridge has a sleeve such that they fit together.

A lifting bar is located In the center of the 6” hollow center of each cartridge near the top of the cartridge. The top cone has a lifting ring on the top of it. For shallow installations, vertical stacks of filters should have an access opening in the structure directly above them or close to being above them to facilitate maintenance.

A winch with a hook is lowered down to hook on to the cone lifting ring and the cone is winched out of the structure. Similarly, the winch is hooked under the lifting bar of each successive filter cartridge and they are winched out of the structure.

Fresh cartridges are similarly winched in stacking them as required ending each stack with a cone. Call Hydroworks at 888-290-7900 since we offer a cartridge exchange program.

The local municipality should be consulted for the allowable disposal options for both the water and sediments that are removed from the HydroFilter.

Filter Cartridge Replenishment

Small HydroFilter units may be able to be replenished to extend the frequency of replacement. Once the top cone is removed an inflatable pipe plug can be lowered through the central core created by the connected filters to the base and expanded at the bottom to seal the vertical core.

This vertical core or pipe can then be filled with clean water to backflush the filter forcing it to flow from the central core opening back through the filter to the outside of each filter cartridge. This backflush water can then be pumped or vacuumed from the structure with the central core still being full of water.

HYDROFILTER INSPECTION SHEET

Date _____
Date of Last Inspection _____

Site _____
City _____
State _____
Owner _____

GPS Coordinates _____

Date of last rainfall _____
Depth of rainfall (last 24h) _____

Site Characteristics	**Yes**	**No**
Soil erosion evident	☐	☐
Exposed material storage on site	☐	☐
Large exposure to leaf litter (lots of trees)	☐	☐
High traffic (vehicle) area	☐	☐

HydroFilter	**Yes**	**No**
Standing water (above outlet invert)	☐ *	☐
Missing internal components	☐ **	☐
Internal component damage (cracked, broken, loose pieces)	☐ **	☐
Floating debris in the structure (oil, leaves, trash)	☐	☐
Concrete cracks/deficiencies	☐ ***	☐
Exposed rebar	☐ **	☐

* Maintenance required
** Repairs required
*** Further investigation is required

Other Comments: _____

_____

_____

_____

_____

_____

_____

_____

Please call Hydroworks at 888-290-7900 or email us at support@hydroworks.com if you have any questions regarding the Inspection Checklist. Please fax a copy of the completed checklist to Hydroworks at 888-783-7271 for our records.

Hydroworks

Hydroworks® HydroFilter

One Year Limited Warranty

Hydroworks, LLC warrants, to the purchaser and subsequent owner(s) during the warranty period subject to the terms and conditions hereof, the Hydroworks HydroFilter to be free from defects in material and workmanship under normal use and service, when properly installed, used, inspected and maintained in accordance with Hydroworks written instructions, for the period of the warranty. The standard warranty period is 1 year.

The warranty period begins once the filter has been manufactured and is available for delivery. Any components determined to be defective, either by failure or by inspection, in material and workmanship will be repaired, replaced or remanufactured at Hydroworks' option provided, however, that by doing so Hydroworks, LLC will not be obligated to replace an entire insert or concrete section, or the complete unit. This warranty does not cover shipping charges, damages, labor, any costs incurred to obtain access to the unit, any costs to repair/replace any surface treatment/cover after repair/replacement, or other charges that may occur due to product failure, repair or replacement.

This warranty does not apply to any material that has been disassembled or modified without prior approval of Hydroworks, LLC, that has been subjected to misuse, misapplication, neglect, alteration, accident or act of God, or that has not been installed, inspected, operated or maintained in accordance with Hydroworks, LLC instructions and is in lieu of all other warranties expressed or implied. Hydroworks, LLC does not authorize any representative or other person to expand or otherwise modify this limited warranty.

The owner shall provide Hydroworks, LLC with written notice of any alleged defect in material or workmanship including a detailed description of the alleged defect upon discovery of the defect. Hydroworks, LLC should be contacted at 257 Cox St., Roselle, NJ 07203 or any other address as supplied by Hydroworks, LLC. (888-290-7900).

This limited warranty is exclusive. There are no other warranties, express or implied, or merchantability or fitness for a particular purpose and none shall be created whether under the uniform commercial code, custom or usage in the industry or the course of dealings between the parties. Hydroworks, LLC will replace any goods that are defective under this warranty as the sole and exclusive remedy for breach of this warranty.

Subject to the foregoing, all conditions, warranties, terms, undertakings or liabilities (including liability as to negligence), expressed or implied, and howsoever arising, as to the condition, suitability, fitness, safety, or title to the Hydroworks HydroFilter are hereby negated and excluded and Hydroworks, LLC gives and makes no such representation, warranty or undertaking except as expressly set forth herein. Under no circumstances shall Hydroworks, LLC be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the HydroFilter, or the cost of other goods or services related to the purchase and installation of the HydroFilter. For this Limited Warranty to apply, the HydroFilter must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and Hydroworks' written installation instructions.

Hydroworks, LLC expressly disclaims liability for special, consequential or incidental damages (even if it has been advised of the possibility of the same) or breach of expressed or implied warranty. Hydroworks, LLC shall not be liable for penalties or liquidated damages, including loss of production and profits; labor and materials; overhead costs; or other loss or expense incurred by the purchaser or any third party. Specifically excluded from limited warranty coverage are damages to the HydroFilter arising from ordinary wear and tear; alteration, accident, misuse, abuse or neglect; improper maintenance, failure of the product due to improper installation of the concrete sections or improper sizing; or any other event not caused by Hydroworks, LLC. This limited warranty represents Hydroworks' sole liability to the purchaser for claims related to the HydroFilter, whether the claim is based upon contract, tort, or other legal basis.

Attachment #3

Stormwater Management System
Quarterly Inspection Form

Inspection Form - Storm Water Management System
Proposed Commercial Building
#39 Alder Street, Medway, Massachusetts

QUARTERLY INSPECTION AND MAINTENANCE REPORT

Jan.-Mar. Apr.-Jun. July-Sep. Oct. – Dec.

Note: This Log should be copied prior to use. Note Additional Comments on back of Form.

Inspector's Name: _____ Date: _____ Time: _____ am/pm

Inspector's Qualifications: _____

Days Since Last Rainfall: _____ Amount of Last Rainfall: _____ inches

Item/Condition to be Checked	Maintenance Required		Corrective Action & Date
	No	Yes	
HYDRODOME WATER QUALITY UNITS			*Clean when sediment Depth > 24 in. or sheen present
HYDROFILTER WATER QUALITY UNITS			Clean Unit Twice /Year or After Spill Event
Catch Basin (CB-1)			Clean Unit Twice /Year or After Spill Event
Catch Basin (CB-3)			Clean Unit Twice /Year or After Spill Event
Rain Garden			
Underground Infiltration Chambers			
Rip-Rap Aprons			
SPILL KIT			
Parking Lot / Driveway Sweeping			*Sweep Seasonally – As Needed
Landscaping / Trash Removal			
Snow Removal (seasonal)			*All De-icing chemical storage to be inside building

Additional Comments: _____